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ENCYCLOPÆDIA BRITANNICA;
OR, A
DICTIONARY
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ARTS, SCIENCES,
AND
MISCELLANEOUS LITERATURE;
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VOL. X.

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ENCYCLOPÆDIA BRITANNICA.

L E S

^{Lestoff, L. Estrange.} **LESTOFF**, or **LESTOFF**, a town of Suffolk in England, seated on the sea-shore, 117 miles north-west of London. It is concerned in the fisheries of the North-sea, cod, herrings, mackerels, and sprats; has a church, and a dissenting meeting-house; and for its security, six eighteen-pounders, which they can move as occasion requires; but it has no battery. The town consists of 500 houses; but the streets, though tolerably paved, are narrow. It has a market on Wednesdays, and two fairs in the year for petty chapmen. The coast is there very dangerous for strangers.

L'ESTRANGE (Sir Roger), a noted writer in the 17th century, was descended from an ancient family, seated at Hunstanton-hall in the county of Norfolk, where he was born in 1616, being the youngest son of Sir Hammond L'Estrange baronet, a zealous royalist. Having in 1644 obtained a commission from King Charles I. for reducing Lynn in Norfolk, then in possession of the parliament, his design was discovered, and his person seized. He was tried by a court martial at Guildhall in London, and condemned to die as a spy; but was reprieved, and continued in Newgate for some time. He afterward went beyond sea; and in August 1653 returned to England, where he applied himself to the protector Oliver Cromwell, and having once played before him on the bass-viol, he was by some nicknamed *Oliver's fiddler*. Being a man of parts, master of an easy humorous style, but withal in narrow circumstances, he set up a newspaper, under the title of *The Public Intelligence*, in 1663; but which he laid down, upon the publication of the first London gazette in 1665, having been allowed, however, a consideration by government. Some time after the Popish plot, when the Tories began to gain the ascendant over the Whigs, he, in a paper called the *Observer*, became a zealous champion for the former. He was afterwards knighted, and served in the parliament called by King James II. in 1685. But things taking a different turn in that prince's reign, in point of liberty of conscience, from what most people expected, our author's *Observers* were disused as not at all suiting the times. However, he continued licensor of the press till King William's accession, in whose reign he met with some trouble as a dissipated person. However, he went to his grave in peace, after he had in a manner surived his intellectuals. He published a great many political tracts, and translated several works from the Greek, Latin, and Spanish; viz. Josephus's works, Cicero's Offices, Seneca's Morals, Erasmus's Colloquies, Æsop's Fables, and Bonas's Guide to Eternity. The character of his style has been variously represented; his language being observed by

Vol. X. Part I.

L E T

some to be easy and humorous, while Mr Gordon says, ^{Lestweithel, Lethargy.} "that his productions are not fit to be read by any who have taste or good-breeding. They are full of phrases picked up in the streets, and nothing can be more low or nauseous."

LESTWEITHEL, a town of Cornwall in England, about 229 miles distant from London. It is a well-built town, where are kept the common gaol, the weights and measures for the whole stannary, and the county courts. It stands on the river Foy, which brought up vessels from Fowey, before it was choaked up with sand coming from the tin-mines, and therefore its once flourishing trade is decayed; but it holds the buhelage of coals, salt, malt, and corn, in the town of Fowey, as it does the anchorage in its harbour. It was made a corporation by Richard earl of Cornwall when he was king of the Romans, and has had other charters since. It consists of seven capital burgesses (whereof one is a mayor), and 17 assistants or common council. It is part of the duchy of Cornwall, to which it pays L. 11 : 19 : 10 a year for its liberties. Its chief trade is the woollen manufactory. Its church has a spire, the only one except that of Helston in the county. Its market is Friday, and its fairs are three. It first returned members to parliament in the 33d of Edward I. They are chosen by their burgesses and assistants. It was anciently the shire-town, and the knights of the shire are still chosen here.

LETLCHLADE, a town of Gloucestershire, 90 miles from London, on the borders of Oxfordshire and Berks, and the great road to Gloucester; had anciently a nunnery, and a priory of black canons. In this parish is Clay-hill. The market is on Tuesday; and it has two fairs. It is supposed to have been a Roman town: for a plain Roman road runs from hence to Cirencester; and by digging in a meadow near it some years ago, an old building was discovered, supposed to be a Roman bath, which was 50 feet long, 40 broad, and 4 high, supported with 100 brick pillars, curiously inlaid with stones of divers colours of tesseraic work. The Leech, the Coln, the Churn, and Isis, which all rise in the Cotswould-hill, join here in one full stream, and become one river, called the *Thames*, which begins here to be navigable, and barges take in butter, cheese, and other goods, at its quay for London.

LETHARGY, in medicine (from *λεθη* oblivion, and *αργεια* numbness, *lusingis*), a disease consisting of a profound drowsiness or sleepiness, from which the patient can scarce be awaked; or, if awaked, he remains stupid, without sense or memory, and presently sinks again into his former sleep. See *MEDICINE-Index*.

LETHARGY, in fariery. See there, § 9.

A

LETHE,

Lethe
||
Letter.

Letter.

LETHE, in the ancient mythology, one of the rivers of hell, signifying oblivion or forgetfulness; its waters extend, according to poetic fiction, the peculiar quality of making those who drank them forget every thing that was past.

LETI (Gregorio), an eminent Italian writer, was descended of a family which once made a considerable figure at Bologna: Jerom, his father, was page to prince Charles de Medicis; served some time in the troops of the grand duke as captain of foot; and settling at Milan, married there in 1628. He was afterward governor of Almontea in Calabria, and died at Salerno in 1639. Our author was born at Milan in 1630, studied under the Jesuits at Cosenza, and was afterward sent by an uncle to Rome, who would have him enter into the church; but he being averse to it, went into Geneva, where he studied the government and the religion there. Thence he went to Lausanne; and contracting an acquaintance with John Anthony Guerin, an eminent physician, lodged at his house, made profession of the Calvinist religion, and married his daughter. He settled at Geneva; where he spent almost twenty years, carrying on a correspondence with learned men, especially those of Italy. Some contests obliged him to leave that city in 1679; upon which he went to France, and then into England, where he was received with great civility by Charles II. who, after his first audience, made him a present of a thousand crowns, with a promise of the place of historiographer. He wrote there the History of England; but that work not pleasing the court on account of his too great liberty in writing, he was ordered to leave the kingdom. He went to Amsterdam in 1682, and was honoured with the place of historiographer to that city. He died suddenly in 1701. He was a man of indefatigable application, as the multiplicity of his works show. The principal of these are, 1. The universal monarchy of Louis XIV. 2. The life of Pope Sixtus V. 3. The life of Philip II. king of Spain. 4. The life of the emperor Charles V. 5. The life of Elizabeth, queen of England. 6. The history of Oliver Cromwell. 7. The history of Great Britain, 5 vols 12mo. 8. The history of Geneva, &c.

LETRIM, a county of Ireland, in the province of Connaught, 44 miles in length and 17 in breadth; bounded on the east and north-east by Cavan and Fermanagh, by Sligo and Roscommon on the west and south-west, and by Longford on the east and south-east. It is a hilly country, with rank grass, which feeds a great number of cattle. The chief town is Letrim, seated not far from the river Shannon. It contains 4000 houses, 21 parishes, 5 baronies, 2 boroughs, and sends 6 members to parliament.

LETTER, a character used to express one of the simple sounds of the voice; and as the different simple sounds are expressed by different letters, these, by being differently compounded, become the visible signs or characters of all the modulations and mixtures of sounds used to express our ideas in a regular language; (See LANGUAGE). Thus, as by the help of speech we render our ideas audible; by the assistance of letters we render them visible, and by their help we can wrap up our thoughts, and send them to the most distant parts of the earth, and read the transactions of different ages. As to the first letters, what they were, who first in-

vented them, and among what people they were first in use, there is still room to doubt: Philo attributes this great and noble invention to Abraham; Josephus, St Irenæus, and others, to Enoch; Bibliander, to Adam; Eusebius, Clemens Alexandrinus, Cornelius Agrippa, and others, to Moses; Pomponius Mela, Herodian, Rufus Festus, Pliny, Lucan, &c. to the Phœnicians; St Cyprian, to Saturn; Tacitus, to the Egyptians; some, to the Ethiopians; and others, to the Chinese: but, with respect to these last, they can never be intitled to this honour, since all their characters are the signs of words, formed without the use of letters; which renders it impossible to read and write their language without a vast expence of time and trouble; and absolutely impossible to print it by the help of types, or any other manner but by engraving, or cutting in wood. See PRINTING.

There have been also various conjectures about the different kinds of letters used in different languages: thus, according to Crinitus, Moses invented the Hebrew letters; Abraham, the Syriac and Chaldee; the Phœnicians, those of Attica, brought into Greece by Cadmus, and from thence into Italy by the Pelasgians; Nicotratra, the Roman; Isis, the Egyptian; and Vulfilas, those of the Goths.

It is probable, that the Egyptian hieroglyphics were the first manner of writing: but whether Cadmus and the Phœnicians learned the use of letters from the Egyptians, or from their neighbours of Judea or Samaria, is a question; for since some of the books of the Old Testament were then written, they are more likely to have given them the hint, than the hieroglyphics of Egypt. But wheresoever the Phœnicians learned this art, it is generally agreed, that Cadmus the son of Agenor first brought letters into Greece; whence, in following ages, they spread over the rest of Europe. See ALPHABET and WRITING.

Letters make the first part or elements of grammar; an assemblage of these compose syllables and words, and these compose sentences. The alphabet of every language consists of a number of letters, which ought each to have a different sound, figure, and use. As the difference of articulate sounds was intended to express the different ideas of the mind, so one letter was originally intended to signify only one sound, and not, as at present, to express sometimes one sound and sometimes another; which practice has brought a great deal of confusion into the languages, and rendered the learning of the modern tongues much more difficult than it would otherwise have been. This consideration, together with the deficiency of all the known alphabets, from their wanting some letters to express certain sounds, has occasioned several attempts towards an universal alphabet, to contain an enumeration of all such single sounds or letters as are used in any language. See ALPHABET.

Grammarians distinguish letters into vowels, consonants, mutes, liquids, diphthongs, and characteristics. They are likewise divided into capital and small letters. They are also denominated from the shape and turn of the letters; and in writing are distinguished into different hands, as round-text, German-text, round-hand, Italian, &c. and in printing, into Roman, Italic, and black letter.

The term LETTER, or Type, among printers, not on-

Letter. ly includes the CAPITALS, SMALL CAPITALS, and small letters, but all the points, figures, and other marks cast and used in printing; and also the large ornamental letters, cut in wood or metal, which take place of the illuminated letters used in manuscripts. The letters used in printing are cast at the ends of small pieces of metal, about three quarters of an inch in length; and the letter being not indented, but raised, easily gives the impression, when, after being blacked with a glutinous ink, paper is closely pressed upon it. See the articles PRINTING and TYPE. A fount of letters includes small letters, capitals, small capitals, points, figures, spaces, &c.; but besides, they have different kinds of two-line letters, only used for titles, and the beginning of books, chapters, &c. See FOUNT.

LETTER is also a writing addressed and sent to a person. See EPISTLE.

The art of epistolary writing, as the late translator of Pliny's Letters has observed, was esteemed by the Romans in the number of liberal and polite accomplishments; and we find Cicero mentioning with great pleasure, in some of his letters to Atticus, the elegant specimen he had received from his son of his genius in this way. It seems indeed to have formed part of their education; and, in the opinion of Mr Locke, it well deserves to have a share in ours. "The writing of letters (as that judicious author observes) enters so much into all the occasions of life, that no gentleman can avoid shewing himself in compositions of this kind. Occurrences will daily force him to make this use of his pen, which lays open his breeding, his sense, and his abilities, to a severer examination than any oral discourse." It is to be wondered we have so few writers in our own language who deserve to be pointed out as models upon such an occasion. After having named Sir William Temple, it would perhaps be difficult to add a second. The elegant writer of Cowley's life mentions him as excelling in this uncommon talent; but as that author declares himself of opinion, "That letters which pass between familiar friends, if they are written as they should be, can scarce ever be fit to see the light," the world is deprived of what no doubt would have been well worth its inspection. A late distinguished genius treats the very attempt as ridiculous, and professes himself "a mortal enemy to what they call a fine letter." His aversion however was not so strong, but he knew to conquer it when he thought proper; and the letter which closes his correspondence with bishop Atterbury is, perhaps, the most genteel and manly address that ever was penned to a friend in disgrace. The truth is, a fine letter does not consist in saying fine things, but in expressing ordinary ones in an uncommon manner. It is the *proprie communia dicere*, the art of giving grace and elegance to familiar occurrences, that constitutes the merit of this kind of writing. Mr Gay's letter, concerning the two lovers who were struck dead with the same flash of lightning, is a master-piece of the sort; and the specimen he has there given of his talents for this species of composition makes it much to be regretted we have not more from the same hand.

Ward's
Oratory.

Of the Style of Epistolary Composition. Purity in the choice of words, and justness of construction, joined with perspicuity, are the chief properties of this style.

Accordingly Cicero says: "In writing letters, we make use of common words and expressions." And Seneca more fully, "I would have my letters to be like my discourses, when we either sit or walk together, unstudied and easy." And what prudent man, in his common discourse, aims at bright and strong figures, beautiful turns of language, or laboured periods? Nor is it always requisite to attend to exact order and method. He that is master of what he writes, will naturally enough express his thought without perplexity and confusion; and more than this is seldom necessary, especially in familiar letters.

Indeed, as the subjects of epistles are exceedingly various, they will necessarily require some variety in the manner of expression. If the subject be something weighty and momentous, the language should be strong and solemn; in things of a lower nature, more free and easy; and upon lighter matters, jocose and pleasant. In exhortations, it ought to be lively and vigorous; in consolations, kind and compassionate; and in advising, grave and serious. In narratives, it should be clear and distinct; in requests, modest; in commendations, friendly; in prosperity cheerful, and mournful in adversity. In a word, the style ought to be accommodated to the particular nature of the thing about which it is conversant.

Besides, the different character of the person, to whom the letter is written, requires a like difference in the modes of expression. We do not use the same language to private persons, and those in a public station; to superiors, inferiors, and equals. Nor do we express ourselves alike to old men and young, to the grave and facetious, to courtiers and philosophers, to our friends and strangers. Superiors are to be addressed to with respect, inferiors with courtesy, and equals with civility; and every one's character, station, and circumstances in life, with the relation we stand in to him, occasions some variety in this respect. But when friends and acquaintances correspond by letters, it carries them into all the freedom and good-humour of conversation; and the nearer it resembles that, the better, since it is designed to supply the room of it. For when friends cannot enjoy each others company, the next satisfaction is to converse with each other by letters. Indeed, sometimes greater freedom is used in epistles, than the same persons would have taken in discoursing together; because, as Cicero says, "A letter does not blush." But still nothing ought to be said in a letter, which, considered in itself, would not have been fit to say in discourse; though modestly perhaps, or some other particular reason, might have prevented it. And thus it frequently happens in requests, reproofs, and other circumstances of life. A man can ask that by writing, which he could not do by words, if present; or blame what he thinks amiss in his friend with greater liberty when absent, than if they were together. From hence it is easy to judge of the fitness of any expression to stand in an epistle, only by considering, whether the same way of speaking would be proper in talking with the same person. Indeed, this difference may be allowed, that as persons have more time to think, when they write, than when they speak; a greater accuracy of language may sometimes be expected in one,

Letter,
Lettuce.

than the other. However, this makes no odds as to the kind of style; for every one would choose to speak as correctly as he writes, if he could. And therefore all such words and expressions, as are unbecoming in conversation, should be avoided in letters; and a manly simplicity free of all affectation, plain, but decent and agreeable, should run through the whole. This is the usual style of Cicero's epistles, in which the plainness and simplicity of his diction is accompanied with something so pleasant and engaging, that he keeps up the attention of his reader, without suffering him to tire. On the other hand, Pliny's style is fuscini and witty; but generally so full of turns and quibbles upon the sound of words, as apparently render it more stiff and affected than agrees with conversation, or than a man of sense would choose in discourse, were it in his power. You may in some measure judge of Pliny's manner, by one short letter to his friend, which runs thus: "How fare you? As I do in the country? pleasantly? that is, at leisure? For which reason I do not care to write long letters, but to read them; the one as the effect of niceness, and the other of idleness. For nothing is more idle than your nice folks, or curious than your idle ones. Farewell." Every sentence here consists of an antithesis, and a jingle of words, very different from the style of conversation, and plainly the effect of study. But this was owing to the age in which he lived, at which time the Roman eloquence was sunk into pins, and an affectation of wit; for he was otherwise a man of fine sense and great learning.

LETTER of Attorney, in law, is a writing by which one person authorises another to do some lawful act in his stead; as to give seizure of lands, to receive debts, sue a third person, &c.

The nature of this instrument is to transfer to the person to whom it is given, the whole power of the maker, to enable him to accomplish the act intended to be performed. It is either general or special: and sometimes it is made revocable, which is when a bare authority is only given; and sometimes it is irrevocable, as where debts, &c. are assigned from one person to another. It is generally held, that the power granted to the attorney must be strictly pursued; and that where it is made to three persons, two cannot execute it. In most cases, the power given by a letter of attorney determines upon the death of the person who gave it. No letter of attorney made by any seamen, &c. in any ship of war, or having letters of marque, or by their executors, &c. in order to empower any person to receive any share of prizes or bounty-money, shall be valid, unless the same be made revocable, and for the use of such seamen, and be signed and executed before, and attested by, the captain and one other of the signing officers of the ship, or the mayor or chief magistrate of some corporation.

LETTER of Mart or Marque. See *MARQUE*.

LETTERS Patent or Overt, are writings sealed with the great seal of England, whereby a man is authorised to do, or enjoy any thing, which, of himself, he could not do. See *PATENT*.—They are so called, by reason of their form; as being open, with the seal affixed, ready to be shown for the confirmation of the authority given by them.

LETTUCE, in botany. See *LACTUCA*.

Levant
Leucata.

LEVANT, in geography, signifies any country situated to the east of us, or in the eastern side of any continent or country, or that on which the sun rises.

LEVANT, is also a name given to the eastern part of the Mediterranean sea, bounded by Natolia or the Lesser Asia on the north, by Syria and Palestine on the east, by Egypt and Barca on the south, and by the island of Candia and the other part of the Mediterranean on the west.

LEVATOR, in anatomy, a name given to several muscles. See *ANATOMY*, *Table of the Muscles*.

LEUCA, in antiquity, a geographical measure of length in use among the later Gauls; which, according to Jornandes, who calls it *leuca*, contained fifteen hundred paces, or one mile and a half. Hence the name of *league*, now reckoned at three miles; in the lower age, called *leuca*.

LEUCADENDRON, in botany: A genus of the monogynia order, belonging to the tetrandria class of plants; and in the natural method ranking under the 48th order, *Aggregate*. The florets are tripetalous, with one petal of each trisid; the receptacle is a little villous; there is no proper calyx; the anthers are almost coalited.

LEUCADIA, formerly called *Neritis*, a peninsula of Acarnania, (Homer); but afterwards, by cutting through the peninsula, made an island, as it is at this day, called *St Maura*.

LEUCAS, (anc. geog.), formerly called *Neritos* and *Neritus*, a town of Leucadia or Leucas; situated near a narrow neck of land, or isthmus, on a hill facing the east and Acarnania: the foot or lower part of the town was a plain lying on the sea by which Leucadia was divided from Acarnania, (Livy); though Thucydides places Leucas more inward in the island, which was joined to the continent by a bridge. It was an illustrious city, the capital of Acarnania, and the place of general assembly.

LEUCATA, or *LEVATE*, (anc. geog.); a promontory of Leucadia according to Strabo, a white rock projecting into the sea towards Cephalonia, on which stood a temple of Apollo surnamed *Leucadius*. At his festival, which was annually celebrated here, the people were accustomed to offer an expiatory sacrifice to the god, and to avert on the head of the victim all the calamities with which they might be threatened. For this purpose, they made choice of a criminal condemned to die; and leading him to the brink of the promontory, precipitated him into the sea amidst the loud shouts of the spectators. The criminal, however, seldom perished in the water: for it was the custom to cover him with feathers, and to fasten birds to his body, which by spreading their wings might serve to break his fall. No sooner did he touch the sea, than a number of boats stationed for the purpose flew to his assistance, and drew him out; and after being thus saved, he was banished for ever from the territory of Leucadia. (Strabo, lib. 10. p. 452.)

According to ancient authors, a strange opinion concerning this promontory prevailed for some time among the Greeks. They imagined that the leap of Leucata was a potent remedy against the violence of love. Hence disappointed or despairing lovers, it is said, were often known to have come to Leucadia; and, having ascended the promontory, offered sacrifices

Leucippus
||
Leucoma.

§ Ptolem.
Hephæst.
ap. Phot.
p. 491.

† Herodot.
lib. 8.
cap. 87.

‡ Ptolem.
Hephæst.
lib. 8.

fices in the temple, and engaged by a formal vow to perform the desperate act, to have voluntarily precipitated themselves into sea. Some are reported to have recovered from the effects of the fall; and among others mention is made of a citizen of Bathroton, in Epirus, whose passions always taking fire at new objects, he four times had recourse to the same remedy, and always with the same success. As those who made the trial, however, seldom took any precaution to render their falls rapid, they were generally destroyed; and women often fell victims to this act of desperation.—At Leucata was shown the tomb of Artemisia, that celebrated queen of Caria who gave so many proofs of courage at the battle of Salamis†. Inflamed with a violent passion for a young man who inflexibly refused her love, she surprised him in his sleep and put out his eyes. Regret and despair soon brought her to Leucata, where she perished in the waves notwithstanding every effort to save her‡. Such likewise was the end of the unhappy Sappho. Forsaken by her lover Phaon, she came hither to seek relief from her sufferings, and found her death. (*Menand. ap. Sirab. lib. 10. p. 452.*)

LEUCIPPUS, a celebrated Greek philosopher and mathematician; first author of the famous system of atoms and vacuums, and of the hypothesis of storms; since attributed to the moderns. He flourished about 428 B. C.

LEUCOGÆUS, (anc. geog.), a hill situated between Puteoli and Neapolis in Campania, abounding in sulphur; now *L'Alumera*. Whence there were also springs called *Leucogæi fontes*; the waters of which, according to Pliny, gave a firmness to the teeth, cleared to the eyes, and proved a cure in wounds.

LEUCOJUM, GREAT SNOW-DROP: a genus of the monogynia order, belonging to the hexandria class of plants; and in the natural method ranking under the ninth order, *Spathaceæ*. The corolla is campanulate, sexpartite, the segments increased at the points, the stigma simple.

Species. 1. The vernal, or spring leucojum, has an oblong bulbous root, sending up several flat leaves six or eight inches long; and amidst them an upright, channelled, hollow, naked stalk, about a foot high, terminated by a spatula, protruding one or two white flowers on slender footstalks drooping downwards, and appearing in March. 2. The ætival, or summer leucojum, has a large, oblong, bulbous root, crowned with several long, flat, broad leaves; and amidst them an upright, thick, hollow stalk, 15 or 18 inches high; terminated by a spatula, protruding many white flowers, on slender footstalks, drooping downwards; flowering in May. 3. The autumnale, or autumnal leucojum, hath a large oblong bulbous root, crowned with many narrow leaves, an upright, naked, hollow stalk, terminated by a spatula protruding many white flowers on long weak footstalks, hanging downwards, and flowering in autumn.

Culture. All the three species are very hardy, durable in root, and increase exceedingly by offsets, which may be separated every two or three years.

LEUCOMA, in antiquity, was a public register amongst the Athenians, in which were inserted the names of all the citizens, as soon as they were of age to enter upon their paternal inheritance.

LEUCOMA, in surgery, a distemper of the eye, otherwise called *albugo*. See *ALBUGO*, and *SURGERY*.

LEUCOPETRA, (anc. geog.) so called from its white colour (Strabo); a promontory of the Bruttii, in the territory of Rhegium: the termination of the Apennine. The utmost extremity of the Bruttii, or the modern *Calabria Ultra*; as the Japygium is of the ancient Calabria, or the modern Calabria Citra.

LEUCOPETRIANS, in ecclesiastical history, the name of a fanatical sect which sprang up in the Greek and Eastern churches towards the close of the 12th century: the fanatics of this denomination professed to believe in a double Trinity, rejected wedlock, abstained from flesh, treated with the utmost contempt the sacraments of Baptism and the Lord's Supper, and all the various branches of external worship; placed the essence of religion in internal prayer alone, and maintained, as it is said, that an evil being, or genius, dwelt in the breast of every mortal, and could be expelled from thence by no other method than by perpetual supplication to the Supreme Being. The founder of this enthusiastic sect is said to have been a person called *Leucopetrus*, and his chief disciple Ty-chicus, who corrupted, by fanatical interpretations, several books of scripture, and particularly St Matthew's gospel.

LEUCOPHLEGMATIA, in medicine, a kind of dropsy, otherwise called *anasarca*. See (*Index* subjoined to) *MEDICINE*.

LEUCOTHOE, or LEUCOTHEA (fab. hist.), the wife of Athamus, changed into a sea deity; see *ISO*. She was called *Matuta* by the Romans. She had a temple at Rome, where all the people, particularly women, offered vows for their brother's children. They did not treat the deity to protect their own children, because Ivo had been unfortunate in hers. No female slaves were permitted to enter the temple; or if their curiosity tempted them to transgress this rule, they were beaten with the greatest severity. To this supplicating for other people's children, Ovid alludes in these lines;

*Non tamen hanc pro stirpe sua pia mater adorat,
Ipsa parum felix vixisse parens.* Fast. 6.

LEUCTRA, (anc. geog.), a town of Bœotia, to the west of Thebes, or lying between Platææ and Thebæ, where the Lacedæmonians had a great defeat given them by Epaminondas and Pelopidas the Theban generals. The Theban army consisted at most but of 6000 men, whereas that of the enemy was at least thrice that number: but Epaminondas trusted most in his horse, wherein he had much the advantage, both in their quality and good management; the rest he endeavoured to supply by the disposition of his men, and the vigour of the attack. He even refused to suffer any to serve under him in the engagement, but such as he knew to be fully resolved to conquer or die. He put himself at the head of the left wing, opposite to Cleombrotus king of Sparta, and placed the main fleets of the battle there; rightly concluding, that if he could break the body of the Spartans, which was but 12 men deep, whereas his own was 50, the rest would be soon put to flight. He closed his own with the sacred band, which was commanded by Pelopidas; and placed his horse in the front. His right, from which he had drawn so many men, he ordered to fall back.

Level.
Level.

back, in a slanting line, as if they declined to fight, that they might not be too much exposed to the enemy, and might serve him for a corps of reserve in case of need. This was the wife disposition which the two Theban generals made of their few but resolute forces; and which succeeded in every part, according to their wish. Epaminondas advanced with his left wing, extending it obliquely, in order to draw the enemy's right from the main body; and Pelopidas charged them with such desperate speed and fury, at the head of his battalion, before they could reunite, that their horse, not being able to stand the shock, were forced back upon their infantry, which threw the whole into the greatest confusion: so that though the Spartans were of all the Greeks the most expert in recovering from any surprise, yet their skill on this occasion either failed them or proved of no effect; for the Thebans, observing the dreadful impression they had made on them with their horse, pushed furiously upon the Spartan king, and opened their way to him with a great slaughter.

Upon the death of Cleombrotus, and several officers of note, the Spartans, according to custom, renewed the fight with double vigour and fury, not so much to revenge his death as to recover his body, which was such an established point of honour as they could not give up without the greatest disgrace. But here the Theban general wisely chose rather to gratify them in that point, than to hazard the success of a second onset; and left them in possession of their king, whilst he marched straight against their other wing, commanded by Archidamus, and consisted chiefly of such auxiliaries and allies as had not heartily engaged in the Spartan interest: these were so discouraged by the death of the king and the defeat of that wing, that they betook themselves to flight, and were presently after followed by the rest of the army. The Thebans, however, pursued them so closely, that they made a second dreadful slaughter among them; which completed Epaminondas's victory, who remained master of the field, and erected a trophy in memory of it. This was the conclusion of the famed battle of Leuctra, in which the Lacedemonians lost 4000 men, and the Thebans but 300.

LEVEL, an instrument wherewith to draw a line parallel to the horizon, by means of which the true level, or the difference of ascent or descent between several places, may be found, for conveying water, draining fens, &c.

There are several instruments of different contrivance and matter, intended for the perfection of levelling; all of which, for the practice, may be reduced to the following.

Air-Level, that which shows the line of level by means of a bubble of air inclosed with some liquor in a glass-tube of an indeterminate length and thickness, whose two ends are hermetically sealed. When the bubble fixes itself at a certain mark, made exactly in the middle of the tube, the plane or ruler wherein it is fixed is level. When it is not level, the bubble will rise to one end. This glass-tube may be set in another of brass, having an aperture in the middle, whence the bubble of air may be observed. The liquor wherewith the tube is filled is oil of tartar, or aqua secunda; these not rarefaction and condensation, as spirit of wine is.

This application of a bubble of air was the invention of Dr Hooke.

There is one of these instruments made with sights, being an improvement upon that last described, which, by the addition of more apparatus, becomes more commodious and exact. It consists of an air-level, fig. 1. about eight inches long, and seven or eight lines in diameter, set in a brass tube, 2, with an aperture in the middle, C. The tubes are carried in a strong straight ruler, a foot long; at whose ends are fixed two sights, 3, 3, exactly perpendicular to the tubes, and of an equal height, having a square hole, formed by two fillets of brass crossing each other at right angles, in the middle whereof is drilled a very little hole, through which a point on a level with the instrument is descried. The brass tube is fastened on the ruler by means of two screws; one whereof, marked 4, serves to raise or depress the tube at pleasure, for bringing it towards a level. The top of the ball and socket is rivetted to a little ruler that springs, one end whereof is fastened with screws to the great ruler, and at the other end has a screw, 5, serving to raise and depress the instrument when nearly level.

The instrument just described, however, is yet less commodious than the following one; because though the holes be ever so small, yet they will still take in too great a space to determine the point of level precisely.

The instrument alluded to consists of an air-level, with telescope sights. This level (fig. 2.) is like the last; with this difference, that, instead of plain sights, it carries a telescope to determine exactly a point of level at a good distance. The telescope is a little brass-tube, about 15 inches long, fastened on the same ruler as the level. At the end of the tube of the telescope, marked 1, enters the little tube 1, carrying the eye-glasses and an hair horizontally placed in the focus of the object-glass, 2; which little tube may be drawn out, or pushed into the great one, for adjusting the telescope to different sights: at the other end of the telescope is placed the object-glass. The screw 3, is for raising or lowering the little fork, for carrying the hair, and making it agree with the bubble of air when the instrument is level; and the screw 4, is for making the bubble of air, D or E, agree with the telescope: the whole is fitted to a ball and socket. M. Huygens is said to be the first inventor of this level; which has this advantage, that it may be inverted by turning the ruler and telescope half round; and if then the hair cut the same point that it did before, the operation is just.

It may be observed, that one may add a telescope to any kind of level, by applying it upon, or parallel to, the base or ruler, when there is occasion to take the level of remote objects.

Dr Defaguliers contrived an instrument, by which the difference of level of two places, which could not be taken in less than four or five days with the best telescope-levels, may be taken in as few hours. The instrument is as follows. To the ball C (fig. 3.) is joined a recurve tube B A, with a very fine bore, and a small bubble at top A, whose upper part is open. It is evident from the make of this instrument, that if it be inclined in carrying, no prejudice will be done to the liquor, which will always be right both in the ball and tube when the instrument is set upright. If the air at C be so expanded with heat, as to drive the

Level

Plate
CCLXX.

liquor

liquor to the top of the tube, the cavity A will receive the liquor, which will come down again and settle at D, or near it, according to the level of the place where the instrument is, as soon as the air at C returns to the same temperance as to heat and cold. To preserve the same degree of heat, when the different observations are made, the machine is fixed in a tin vessel EF, filled with water up to *g h*, above the ball, and a very sensible thermometer has also its ball under water, that one may observe the liquor at D, in each experiment, when the thermometer stands at the same height as before. The water is poured out when the instrument is carried; which one may do conveniently by means of the wooden frame, which is set upright by the three screws, S, S, S, fig. 4. and a line and plummet P P, fig. 5. At the back part of the wooden frame, from the piece at top K, hangs the plummet P, over a brass point at N; M m are brackets to make the upright board K N continue at right angles with the horizontal one at N. Fig. 6. represents a front view of the machine, supposing the fore part of the tin-vessel transparent; and here the brass-socket of the recurve-tube, into which the ball is screwed, has two wings at I I, fixed to the bottom, that the ball may not break the tube by its endeavour to emerge when the water is poured in as high as *g h*.

After the Doctor had contrived this machine, he considered, that as the tube is of a very small bore, if the liquor should rise into the ball at A (fig. 3.) in carrying the instrument from one place to another, some of it would adhere to the sides or the ball A, and upon its descent in making the experiment, so much might be left behind, that the liquor would not be high enough at D to show the difference of the level: therefore, to prevent that inconvenience, he contrived a blank screw, to shut up the hole at A, as soon as one experiment is made, that, in carrying the machine, the air in A may balance that in C, so that the liquor shall not run up and down the tube, whatever degree of heat and cold may act upon the instrument, in going from one place to another. Now, because one experiment may be made in the morning, the water may be so cold, that when a second experiment is made at noon the water cannot be brought to the same degree of cold it had in the morning; therefore, in making the first experiment, warm water must be mixed with the cold, and when the water has stood some time, before it comes to be as cold as it is likely to be at the warmest part of that day, observe and set down the degree of the thermometer at which the spirit stands, and likewise the degree of the water in the barometer at D; then screw on the cap at A, pour out the water, and carry the instrument to the place whose level you would know; then pour in your water, and when the thermometer is come to the same degree as before, open the screw at top, and observe the liquor in the barometer.

The Doctor's scale for the barometer is ten inches long, and divided into tenths; so that such an instrument will serve for any heights not exceeding ten feet, each tenth of an inch answering to a foot in height.

The Doctor made no allowance for the decrease of density in the air, because he did not propose this machine for measuring mountains (though, with a proper allowance for the decreasing density of the air, it will do very well), but for heights that want to be known

in gardens, plantations, and the conveyance of water, where an experiment that answers two or three feet in a distance of 20 miles, will render this a very useful instrument.

Artillery Foot-Level is in form of a square, having its two legs or branches of an equal length; at a juncture whereof is a little hole, whence hangs a thread and plummet playing on a perpendicular line in the middle of a quadrant. It is divided into twice 45 degrees from the middle. Fig. 7.

This instrument may be used on other occasions, by placing the ends of its two branches on a plane; for when the thread plays perpendicularly over the middle division of the quadrant, that plane is assuredly level. To use it in gunnery, place the two ends on the piece of artillery, which you may raise to any proposed height, by means of the plummet, whose thread will give the degree above the level.

Carpenter's and Pavior's Level, consists of a long ruler, in the middle whereof is fitted, at right angles, another somewhat bigger, at the top of which is fastened a line, which, when it hangs over a fiducial line at right angles with the base, shows that the said base is horizontal. Sometimes this level is all of one board. Fig. 8.

Gunner's Level, for levelling cannons and mortars, consists of a triangular brass plate, about four inches high, fig. 9. at the bottom of which is a portion of a circle, divided into 45 degrees; which number is sufficient for the highest elevation of cannons and mortars, and for giving shot the greatest range: on the centre of this segment of a circle is screwed a piece of brass, by means of which it may be fixed or screwed at pleasure: the end of this piece of brass is made so as to serve for a plummet and index, in order to show the different degrees of elevation of pieces of artillery. This instrument has also a brass foot, to set upon cannons or mortars, so as, when those pieces are horizontal, the instrument will be perpendicular. The foot of this instrument is to be placed on the piece to be elevated, in such a manner, as that the point of the plummet may fall on the proper degree: this is what they call *levelling the piece*.

Mason's Level, is composed of three rules, so joined as to form an isosceles-rectangle, somewhat like a Roman A; at the vertex whereof is fastened a thread, from which hangs a plummet, that passes over a fiducial line, marked in the middle of the base, when the thing to which the level is applied is horizontal; but declines from the mark, when the thing is lower on the one side than on the other.

Plumb or Pendulum Level, that which shows the horizontal lines by means of another line perpendicular to that described by a plummet or pendulum. This instrument, fig. 10. consists of two legs or branches, joined together at right angles, whereof that which carries the thread and plummet is about a foot and a half long; the thread is hung towards the top of the branch, at the point 2. The middle of the branch where the thread passes is hollow, so that it may hang free every where: but towards the bottom, where there is a little blade of silver, whereon is drawn a line perpendicular to the telescope, the said cavity is covered by two pieces of brass, making as it were a kind of case, lest the wind should agitate the thread; for which reason the silver blade is covered with a glass G, to the

Level.

end that it may be seen when the thread and plummet lay upon the perpendicular: the telescope is fastened to the other branch of the instrument, and is about two feet long; having an hair placed horizontally across the focus of the object-glass, which determines the point of the level. The telescope must be fitted at right angles to the perpendicular. It has a ball and socket, by which it is fastened to the foot, and was invented by M. Picard.

Reflecting Level, that made by means of a pretty long surface of water representing the same object inverted which we see erected by the eye, so that the point where these two objects appear to meet is a level with the place where the surface of the water is found. This is the invention of M. Marriotte.

There is another reflecting level consisting of a mirror of steel, or the like, well polished, and placed a little before the object-glass of a telescope, suspended perpendicularly. This mirror must make an angle of 45° with the telescope, in which case the perpendicular line of the said telescope is converted into a horizontal line, which is the same with the line of level. This is the invention of M. Cassini.

Water-Level, that which shows the horizontal line by means of a surface of water or other liquor; founded on this principle, that water always places itself level.

The most simple is made of a long wooden trough or canal, whose sides are parallel to the base; so that being equally filled with water, its surface shows the line of level. This is the chorobates of the ancients. See CHOROBATA.

It is also made with two cups fitted to the two ends of a pipe, three or four feet long, about an inch in diameter, by means whereof the water communicates from the one to the other cup; and this pipe being moveable on its stand by means of a ball and socket, when the two cups become equally full of water, their two surfaces mark the line of level.

This instrument, instead of cups, may also be made with two short cylinders of glass three or four inches long, fastened to each extreme of the pipe with wax or mastic. Into the pipe is poured some common or coloured water, which shows itself through the cylinders, by means whereof the line of level is determined; the height of the water, with respect to the centre of the earth, being always the same in both cylinders; this level, though very simple, is yet very commodious for levelling small distances.

Level of Mr Huygens's invention, consists of a telescope *a*, fig. 11. in form of a cylinder, going through a ferril, in which it is fastened by the middle. This ferril has two flat branches *bb*, one above, and the other below: at the ends whereof are fastened little moving pieces, which carry two rings, by one of which the telescope is suspended to an hook at the end of the screw 3, and by the other a pretty heavy weight is suspended, in order to keep the telescope in *equilibrium*. This weight hangs in the box 5, which is almost filled with linseed oil, oil of walnuts, or other matter that will not easily coagulate, for more aptly settling the balance of the weight and telescope. The instrument carries two telescopes close and very parallel to each other; the eye-glass of the one being against the object-glass of the other, that one may see each way

Level.

without turning the level. In the focus of the object-glass of each telescope must a little hair be strained horizontally, to be raised and lowered as occasion requires by a little screw. If the tube of the telescope be not found level when suspended, a ferril or ring, 4, is put on it, and is to be slid along till it fixes to a level. The hook on which the instrument is hung is fixed to a flat wooden cross; at the ends of each arm whereof there is a hook serving to keep the telescope from too much agitation in using or carriage. To the said flat cross is applied another hollow one, that serves as a case for the instrument; but the two ends are left open, that the telescope may be secured from the weather and always in a condition to be used. The foot of this instrument is a round brass plate, to which are fastened three brass ferrils, moveable by means of joints whereon are put slaves, and on this foot is placed the box.

Fig. 12. marked I, is a balance-level; which being suspended by the ring, the two lights, when in *equilibrium*, will be horizontal, or in a level.

Spirit Level. The most accurate levelling instrument, and that possessed of the greatest essential advantages in use, is the spirit-level; which was first constructed by the late Mr Sisson, and to which some small additions and improvements have been since made. The following is a description of one of the best of these levels, as made by the principal mathematical instrument makers.

Fig. 13. is a representation of the instrument mounted on its complete slaves, copied (except the letters) from Mr Adams's Graphical Essays, Plate xvii. fig. 3. The telescope (ABC) is made from 15 inches to 2 feet in length, as may be required. It is achromatic, of the best kind, and shows the objects erect. In the focus of the eye-glasses are exceedingly fine cross wires, the intersection of which is evidently shewn to be perfectly in the axis of the tube; for by turning it round on its two supporters DE, and looking through the telescope, the intersection of the wires will constantly cut the same part of the object viewed. By turning the screw *a* at the side of the telescope, the object-glass at *g* is moved; and thus the telescope is exactly adapted to the eye. If these cross wires are at any time out of their adjustment, which is discovered by their intersection not cutting the same part of the object during the revolution of the telescope on its axis, they are easily adjusted by means of the four screws *bbb*, placed on the telescope about an inch from the end for the eye. These screws act in perpendicular directions to one another, by unscrewing one and tightening the other opposite to the wire, so that if connected with it, it may be moved either way at pleasure; and in this manner the other wire perpendicular to it may be moved, and thus the intersection of the wires brought exactly in the axis of the tube.

To the telescope is fixed, by two small screws *cc*, the level tube containing the spirits, with a small bubble of air: This bubble of air, when the instrument is well adjusted, will settle exactly in the same place, in or near the middle of its tube, whether the telescope be reversed or not on the supporters, which in this case are kept unmoved.

It is evident, that the axis of the telescope, or the intersection of the wires, as before shown, must be in this case

LEVELS.

Plate CCLXX.

Fig. 1.



Fig. 2.



Fig. 3.

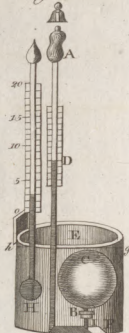


Fig. 4.



Fig. 6.

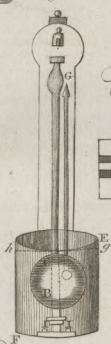


Fig. 14.

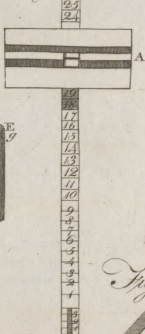


Fig. 5.

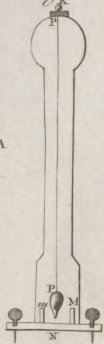


Fig. 9.



Fig. 8.



Fig. 10.

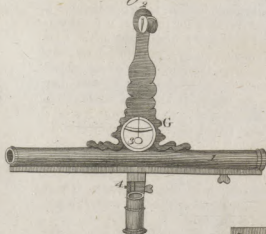


Fig. 7.



Fig. 11.

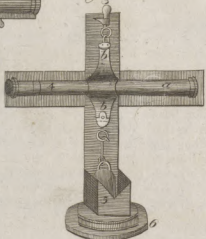
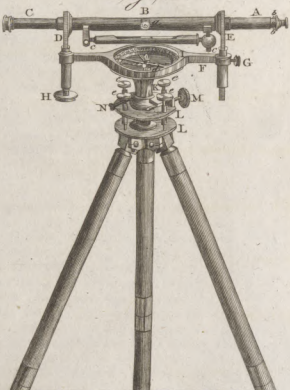


Fig. 12.



Fig. 13.



M. Bell. Prin. Mat. Sculptor fecit.

Level cafe truly level. In this facile mode of adjustment confists the new improvement of the instrument; and it is hereby capable of being adjusted by only one station and one object, which will at the same time determine it to be in a true level. If by change of weather, accident, or otherwise, the instrument should have lost its level adjustment or state, it may thus be readily restored and readjusted at the first station; which is an advantage none of the instruments formerly made have been capable of. The two supporters DE, on which the level rests and turns, are shaped like the letter Y. The telescope rests within the upper part of them; and the inner flides of each of these Ys are tangents to the cylindric tube of the telescope, which is turned to a true cylinder, and each touches it but at one place only.

The lower end of these supporters are inserted into a strong brass plate (FE), and so as to stand perpendicularly on it. One is kept fast by a tightening screw G, and to the other is applied a fine threaded screw H, to adjust the tube when on its supporters to a true level. To the supporter D is sometimes applied a line of tangents as far as 12 degrees, in order to take an angle of depression or elevation to that extent. Between the supporters is also sometimes fixed a compass-box I, divided into 360 degrees, and again into four 90°; having a centre pin and needle, and trigger, at *d*, to throw off the needle from the centre when not used; so in this manner it constitutes a perfect circumference, connected with all the foregoing improvements. This plate is fixed on a conical brass ferrel K, which is adapted to the bell-metal frustum of a cone at top of the brass head of the flaves, having a ball and socket, with three bell-metal joints, two strong brass parallel plates LL, the four screws *eeee* for adjusting the horizontal motion, a regulating screw M to this motion, and a fastening screw N to lighten it off the cone when necessary. The fastening screw N, and the regulating screw M, by which the whole instrument is moved with accuracy through a small space in an horizontal direction, was an addition of Mr Ramsden's.

The manner of adjusting the spirit-level at the first station. The whole level being now placed steadily on its flaves, it must be rendered parallel to the axis of the telescope before you adjust the horizontal motion. To this end the telescope must be placed in a line with two of the screws *ee*, and then levelled thereby till the bubble of air in the spirit-tube keeps its position in the middle, while turned about to three points, making nearly right angles at the centre to one another.

The horizontal motion being thus adjusted, the rims *ff* of the Ys are to be opened, the telescope taken off and laid the contrary way upon the supporters. If the bubble of air then rests exactly the same, the level and telescope are adjusted rightly to one another; but if the bubble does not remain the same, the end to which the air bubble goes must be noticed, and the distance of it from the telescope altered; correcting one half the error by the screws *ee*, and the other half by the screws *ee*.

Now the intersection of the wires being directed to any distant object, it may be one of the vanes of the flaves hereafter described; if they continue to be

Levelling, against it precisely while the telescope is turned round on its Ys, it proves, as before mentioned, that the axis of the telescope coincides with the intersection of the wires, and that the instrument will give the true level direction.

The operation of levelling being of a very accurate and important nature, and the best instrument when out of its adjustment being of little use, it is quite necessary that every person using such an instrument should have it readily in his power to correct it; and the one above described appears to be the best adapted for that purpose of any hitherto contrived.

LEVELLING may be defined, the art which instructs us in finding how much higher or lower any given point on the surface of the earth is than another; or, in other words, the difference in their distance from the centre of the earth.

The practice of levelling therefore consists, 1. In finding and marking two or more points that shall be in the circumference of a circle whose centre is that of the earth. 2. In comparing the points thus found with other points, to ascertain the difference in their distances from the earth's centre.

With regard to the theory of levelling, we must observe, that a plumb-line, hanging freely in the air, points directly towards the centre of the earth; and a line drawn at right angles, crossing the direction of the plumb-line, and touching the earth's surface, is a true level only in that particular spot; but if this line which crosses the plumb be continued for any considerable length, it will rise above the earth's surface, and the apparent level will be above the true one, because the earth is globular; and this rising will be as the square of the distance to which the said right line is produced; that is to say, however much it is raised above the earth's surface at one mile's distance, it will rise four times as much at the distance of two miles, nine times at the distance of three, &c. This is owing to the globular figure of the earth; and this rising is the difference betwixt the true and apparent levels; the real curve of the earth being the true level, and the tangent to it the apparent level. Hence it appears, that the less distance we take betwixt any two stations, the truer will be our operations in levelling; and so soon does the difference betwixt the true and apparent levels become perceptible, that it is necessary to make an allowance for it if the distance betwixt the two stations exceeds two chains in length. The following is an infallible rule for determining the allowance to be made:

"Multiply the number of Gunter's decimal statute *Lead's* ^{*and* *navigational*} chains that are contained in length between any two stations where the levels are to be taken by itself, and the product arising therefrom again by 124; which is a common multiplier for all manner of distances for this purpose on account of the earth's curvature: then divide the second product arising therefrom by 100,000; or, which is also the same, with the dath of the pen cut off five figures on the right hand side of the product, and what remains on the left side is inches, and the five figures cut off decimal parts of an inch."

Levelling. The following is *A Table of Curvature of the Earth* and shows the quantity below the apparent level at the end of every number of chains to 100.

Chains.	Inches.	Chains.	Inches.	Chains.	Inches.	Chains.	Inches.
10.00125	14	0.24	27	0.91	40	2.00	
20.005	15	0.28	28	0.98	45	2.28	
30.01125	16	0.32	29	1.05	50	3.12	
40.02	17	0.36	30	1.12	55	3.78	
50.03	18	0.40	31	1.19	60	4.50	
60.04	19	0.45	32	1.27	65	5.31	
70.06	20	0.50	33	1.35	70	6.12	
80.08	21	0.55	34	1.44	75	7.03	
90.10	22	0.60	35	1.53	80	8.00	
100.12	23	0.67	36	1.62	85	9.03	
110.15	24	0.72	37	1.71	90	10.12	
120.18	25	0.78	38	1.80	95	11.28	
130.21	26	0.84	39	1.91	100	12.50	

Levelling is either simple or compound. The former is when the level points are determined from one station, whether the level be fixed at one of the points or between them. Compound levelling is nothing more than a repetition of many simple operations.

An example of simple levelling is given Plate CCLXXI. fig. 1. where A B are the station points of the level; C D the two points ascertained. Let the height

	Feet.	Inches.
From A to C be	6	0 0
From B to D be	9	0 0

The difference - 3 0 0 shows that B is three feet lower than A.

If the station-points of the level are above the line of sight, as in fig. 2. and the distance from A to C be six feet, and from B to D nine feet, the difference will still be three feet which B is higher than A.

As an example of compound levelling, suppose it were required to know the difference of height between the point A on the river *Zome*, and N on the river *Belann*, fig. 3. (As our author could find no satisfactory examples in any English author, he copied this and the following ones from M. le Febure). In this operation stakes should be driven down at A and N, exactly level with the surface of the water; and these stakes should be so fixed, that they may not be changed until the whole operation be finished: a plan of the ground between the two rivers should then be made, by which it will be discovered, that the shortest way between the rivers is by the dotted line AC, CH, HN; from whence also the number of stations necessary to be taken will be determined. The operator will also be enabled to distribute them properly according to the nature and situation of the ground. In the figure 12. stations are marked. Stakes ought then to be driven in at the limits of each station, as A, B, C, D, &c. They ought to be about two or three inches above the ground, and driven 18 inches into it. Stakes should also be driven in at each station of the instrument, as 1, 2, 3, 4, &c.

The operation may be begun in the following manner. Let the first station be at 1, equally distant from the two points A and B, which themselves are distant 166 yards. Write down then in one column the first limit A; in another, the number of feet, inches, and tenths; with the points of sight indicated on the station-staff at A, viz. 7. 6. 0. In the third column, the second limit B; in the fourth, the height indicated at the station-staff B, viz. 6. 0. 0. Lastly, in the fifth column, the distance from one station-staff to the other; which in this case is 166 yards. Remove now the level to the point marked 2, which is in the middle between B and C, the two places where the station-staves are to be held; observing that B, which was the second limit in the former operation, is the first in this. Then write down the observed heights as before; in the first column B; in the second 4. 6. 0; in the third C; in the fourth 5. 6. 2; in the fifth 560, the distance between B and C.

If being impossible, on account of the inequality of the ground at the third station, to place the instrument in the middle between the two station-staves, find the most convenient point as at 3; then measure exactly how far this is from each station-staff, and you will find that from 3 to C is 160 yards; from 3 to D, 80 yards; and the remainder of the operation will be as in the preceding station.

In the fourth operation, we must endeavour to compensate for any error which might have happened in the last. Mark out, therefore, 80 yards from the station-staff D to the point 4; and 160 yards from 4 to E; and this must be carefully attended to, as by such compensations the work may be much facilitated. Proceed in the same manner with the eight remaining stations, observing to enter every thing in its proper column; and when the whole is finished, add the sums of each column together, and then subtract the lesser from the greater; the difference, which in the present case is 5. 4. 8. shows the ground at N to be thus much lower than the ground at A.

To obtain a section of this level, draw the dotted line *oo*, fig. 4. either above or below the plan; which may be taken for the level or horizontal line. Let fall then perpendiculars upon this line from all the station-points and places where the station-staves were fixed. Beginning now at A, set off 7 feet 6 inches upon the line from A to *a*: for the height of the level-point determined on the staff at this place, draw a line through *a* parallel to the dotted line *oo*, which will cut the third perpendicular at *b*, the second station-staff. Set off from this point downwards six feet to B, which shows the second limit of the first operation; and that the ground at B is one foot six inches higher than at A: place your instrument between these two lines at the height of the level line, and trace the ground according to its different heights. Now set off, on the second station-staff B, four feet six inches to C, the height determined by the level at the second station; and from C draw a line parallel to *oo*, which will cut the fifth perpendicular at *d*, the third station-staff. From this point set off 5 feet 6 inches $\frac{1}{2}$ downwards to C, which will be our second limit with respect to the preceding one and the third with respect to the first. Then draw your instrument in the middle between B and C, and delineate the ground with its inequalities. Proceed

Levelling. ceed in the same manner from station to station, till you arrive at the last N, and you will have the profile of the ground over which the level was taken.

This method answers very well where only a general profile of the different stations is required; but where it is necessary to have an exact detail of the ground between the limits, we must then go to work more particularly. Suppose, therefore, the level to have been taken from A to N by another route; but on more uniform ground, in order to form a canal marked O, P, Q, R, S, T, U, X, Y. Draw at pleasure a line Z, Y, fig. 5. to represent the level, and regulate the rest; then let fall on this line perpendiculars to represent the stakes at the limits of each station, taking care that they be fixed accurately at their respective distances from each other. The difference between the extreme limits, in this case, ought to be the same as in the former, viz. 5 feet 4 inches $\frac{1}{2}$. Set off this measure upon the perpendicular *o* the first limit; and from *o*, prolonging the perpendicular, mark off at *a* the height determined at the first station-staff; then do the same with the second and third, and so on with the following, till this part of the work is finished; there remains then only to delineate in detail the ground between the station-stakes, the distances in this example being assumed larger on account of the detail.

To obtain the section of the ground between O and P, place your instrument at one of the limits, as P, fixing it so that the cross hairs may answer to the point C; then look towards the first limit *o*, raising or depressing the vane till it coincides with the intersection of the cross hairs; and the line of sight from one point to the other will mark the level or horizontal line.

To set off the height of the brink of the river above the first limit, drive a stake down close to the ground at *a*; and place your station-staff upon it, observing where the hairs intersect the vane, which will be at 4 feet 10 inches; then, laying off upon the line *oz* the distance from the first to the last stake, let fall from thence a perpendicular, and set off thereon 4. 10. 0 to *a*, which gives the height at the first stake; or, which is the same, the height from the edge of the river above the surface of the water, as is evident from the section. Draw a second stake at *b*, in a line between the limits; place the station-staff upon this stake, and observe the height 4. 6. intersected by the cross hairs, the instrument still remaining in the same situation. Set off on the level-line the distance from the first stake *a* to the second *b*; and then let fall a perpendicular, and mark upon it 4. 6 to *b*, which gives the height of the ground at this place.

The small hollow *c* is marked out by driving down a third stake even with the ground, in the middle of it at *c*; but the exact distance of the second stake *b* from the third *c*, must be marked upon the level line: then let fall a perpendicular from *c*, and set off upon it 6. 8. 0, pointed out by the cross hairs on the staff, which determines the depth of the hollow, as appears from the figure. As the distances between the stakes are now very short, they can easily be marked by the operator, who can settle any little inequalities by a comparison with those already ascertained. Proceed thus with the other stations till you arrive at the last, and you will always obtain an accurate section of your

work; by which it is easy to form a just estimation of the land to be dug away, in order to form the canal, by adding the depth to be given to it.

Fig. 6. gives an example of compound levelling, where the situation is so steep and mountainous, that the stakes cannot be placed at equal distances from the instrument, or where it is even impossible to make a reciprocal levelling from one station to the other. Thus suppose the point K to be the bottom of a bafon where it is required to make a fountain, the reservoir being at *A*; so that, in order to know the height to which the jet d'eau will rise, it is necessary to know how high the point A is above K.

In great heights such as this, it will be necessary to proceed by small descents, as from A to D. The instrument must be adjusted with all possible care; and it will even be proper, in some part of the work, to use a smaller instrument. The following is a table of the different operations used in making this level, it having been taken from M. le Febure's practice.

	feet	in.	feet	in.	yards
A	21	6	C	0	9 90
C	4	3	D	0	3 40
D	3	9	E	16	3 350
E	5	0	F	17	9 250
F	10	6	G	5	0 375
G	5	0	H	19	0 300
H	5	0	K	47	3 1000
	95	0		106	9 2405

In this case only two levellings are made between A and D, though more would have been necessary; but they are omitted to avoid confusion. In the fourth station the height found was 16 feet 8 inches; but on account of the great length, it was requisite to reduce the apparent level to the true one, which is always necessary where the length is considerable. At the last limit we get the height from N to *o*; then from *o* to I; from I to K, fig. 7. &c.; all which added together, and then corrected for the curvature, gives 47 feet 3 inches. Now, by adding each column together, and subtracting one from the other, we have 51 feet 9 inches for the height which the point A is above the bottom of the bafon, and which will cause the jet d'eau to rise about 45 feet. The general section of this operation is shown at fig. 7. 8. but an exact profile of the mountain is more difficult, as requiring many operations; though some of these might be obtained by measuring from the level line without moving the instrument.

The last example given by our author is likewise from M. le Febure, and includes a length of near five German miles (25 of ours) in a straight line, and 9 or 10 (45 or 50 English) including the turnings and windings. In this the declivity of the river Haynois was measured from Lignebruk to Villebourg. The first operation was to drive stakes at several parts of the river even with the water's edge; the first of which a little above the mills of Lignebruk showed the upper water-mark, and another showed the lower water-mark at the same mills. Two stakes above and below the mills of Mazuranc, somewhat more than half way between Lignebruk and Villebourg, pointed

Levelling
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 Lever.

out the difference between high and low water there, and formed likewise the third and fourth limits of the operation; while the stakes above and below the mills of Villebourg pointed out the difference between high and low water, and likewise formed the last limits of the operation.

These marks were all made at the edge of the water, exactly even with its surface, and all made at the different parts of the river nearly at the same instant of time. "The principal limits of the levelling (says Mr Adams) being now determined and fixed, it only remains to find the level between the limits, according to the methods already pointed out, using every advantage that may contribute to the success of the work, and at the same time avoiding all obstacles and difficulties that may retard or injure the operations. The first rule is always to take the shortest possible way from one limit to another, though this rule ought not to be followed if there are considerable obstacles in the way, as hills, woods, marshy ground, or if, by going aside, any advantage can be obtained." In the present case it was found necessary to deviate very considerably from the general rule, in order to take in several ponds, the surfaces of which might all be taken for a perfect level; and thus levels were frequently taken across the country for a considerable way. The difference of height between the mills of Lignebruk and Villebourg was at last found to be about 19 feet, indicating a descent of not quite a foot in a mile.

LEVELLING-STAVES, instruments used in levelling, serving to carry the marks to be observed, and at the same time to measure the heights of those marks from the ground. They usually consist of two mahogany flaves ten feet long, in two parts, that slide upon one another to about $5\frac{1}{2}$ feet, for the more portable carriage. They are divided into 1000 equal parts, and numbered at every tenth division by 10, 20, 30, &c. to 1000; and on one side the feet and inches are also sometimes marked.

A vane A slides up and down upon each set of these flaves, which by brass springs will stand at any part. These vanes are about 10 inches long and 4 inches broad; the breadth is first divided into three equal parts, the two extremes painted white, the middle space divided again into three equal parts, which are less; the middle one of them is also painted white, and the two other parts black; and thus they are suited to all the common distances. These vanes have each a brass wire across a small square hole in the centre, which serve to point out the height correctly, by coinciding with the horizontal wire of the telescope of the level.

LEVEN, a river of Lenox or Dunbartonshire in Scotland. See LENOX.

LEVER, in mechanics, is a bar of iron or wood, one part of which being supported by a prop, all other parts turn upon that prop as their centre of motion. This instrument is of two kinds. First, the common sort, where the weight we desire to raise, rests at one end of it, our strength is applied at the other end, and the prop is between both. When we stir up the fire with a poker, we make use of this lever; the poker is the lever, it rests upon one of the bars of the grate as a prop, the incumbent fire is the weight to be overcome, and the other end held in the hand is the strength

or power. In this as in all the rest, we have only to increase the distance between the strength and prop to give the man that works the instrument greater power.

The lever of the second kind, has the prop at one end, the strength is applied to the other, and the weight to be raised rests between them. Thus in raising the water-plug in the streets, the workman puts his iron lever through the hole of the plug till he reaches the ground on the other side, and, making that his prop, lifts the plug with his strength at the other end of the lever. In this lever also, the greater the distance of the prop from the strength, the greater is the workman's power.

These instruments, as we see, assist the strength; but sometimes a workman is obliged to act at a disadvantage, in raising either a piece of timber or a ladder upon one end. We cannot, with grammatical propriety, call this a *lever*, since such a piece of timber in fact in no way contributes to raise the weight. In this case, the man, who is the strength or power, is in the middle, the part of the beam already raised is the weight, the part yet at the ground is the prop on which the beam turns or rests. Here the man's strength will be diminished, in proportion to the weight it sustains. The weight will be greater the farther it is from the prop, therefore the man will bear the greater weight the nearer he is to the prop. See MECHANICS.

LEVERET, among sportsmen, denotes a hare in the first year of her age.

LEVIGATION, in pharmacy and chemistry, the reducing hard and ponderous bodies to an impalpable powder, by grinding them on a porphyry, or in a mill. See CHEMISTRY, n^o 599.

A new method of reducing powders to a great degree of fineness has lately been invented by means of a fanner. This has the advantage over the other methods, in being much more expeditious, and attended with less trouble and expence; the degree of fineness to which they are reducible being thus also in a manner unlimited. The construction of the fanner employed for this purpose is different from that employed for winnowing corn; the blast not being collected into a small compass as in the latter, but diffused over a considerable space, lest a violent blast should hurry off both coarse and fine together. For this purpose, the leaves of the fanner are made as long in the direction parallel to the axis as can be done conveniently. In the other direction projecting from it, they differ not from the ordinary length, nor do they in the general situation with respect to each other. Before the leaves is a wooden partition reaching half way up, to prevent the gross powder from falling in among the leaves, which reaches about half way from bottom to top; and about two feet or less from this, according to the size of the fanner, is another partition in a sloping direction, reaching from the bottom of the box to near the top. The whole is inclosed in a large box six or seven feet long, having in the end farthest off from the leaves a slit equal to the space left betwixt the top of the box and the sloping partition already mentioned. On the top of this is another box, extending from the farthest end of the former to the hopper which holds the coarse powder, with a hole in the end nearest to the fanner; and upon this another

Leveret,
 Levigation.

Plate
 CCLXX.
 fig. 14.



Levigation. box, &c. as long as it is found that the air carries off with it any quantity of powder. This will be best understood from the following description of the figure.

Plate CCLXXXI. A represents the fanter itself, having a hole in the case for the admission of the air, as usual.

B, The first wooden division, to prevent the return of the powder upon the leaves of the fanter.

C, The second division, reaching not quite to the top of the box. Its use is to direct the current of air produced by the fanter obliquely upwards: thus it strikes the powder, falling down from the hopper, in the same oblique direction, and carries off the fine parts, first through the aperture *a*; after which some of them are lodged in the box D; the still finer particles are carried through the aperture *b* into the second box E, where part of them are lodged: they next pass through the aperture *c* into the box F, and through *d* into the box G; the powder becoming still finer and in smaller quantity as it ascends into the higher boxes, until at last the waste becomes so trifling, that the air may be allowed to pass off entirely through the aperture *b* in the fourth or some other box, as is found most convenient.

Thus it is evident we may obtain powders of every degree of fineness, and such as neither sieve nor levigating mill could equal. Washing over with water may indeed produce powders equally fine; but the length of time requisite for settling, and the trouble of drying them again, must decidedly give the preference to the fanter; especially when we consider, that there is not any occasion for taking out the powder in small quantities, as is the case in sifting, washing, or levigating; but it may be allowed to remain till as much is collected in the boxes as we desire.

The principal difficulty in the construction of this fanter is the letting down the powder in a proper manner, so that the stream of air, which ought not to be very strong, may freely pass through it. For this purpose, the hopper must not let it fall in a large body, as in winnowing of corn, but in a long and thin sheet, which can easily be pervaded. The best method seems to be to make the hopper extend the whole breadth of the box, having a narrow slit at bottom. Close on the under part of this slit, a fluted roller ought to turn, which shutting up the aperture exactly, cannot allow any powder to pass but what does so in consequence of the hollow flutes of the roller; for a smooth round one would allow nothing to pass. It would be proper also that the flutes be but small, that a thin and nearly continued stream of powder be always descending; for this will contribute greatly to the fineness of the produce: and on this account the powder ought, before it is put into the hopper, to be passed through a lawn sieve. In the figure, *e* represents the hopper, and *f* the fluted roller. Motion is easily communicated to the latter by means of a wheel fastened on the axis of the fanter.

The coarse powder is kept back by the partition C, and descends through a slit *i* in the bottom of the lowermost box, into a receptacle *k*, which may be removed occasionally. All the joints and seams of the machine must be very close, for the fine powder is very penetrating; for this reason also the hopper ought to have a lid.

LEWDNESS. See FORNICATION.—Lewdness is punishable by our law by fine, imprisonment, &c. And Mich. 15 Car. II. a person was indicted for open lewdness, in showing his naked body in a balcony, and other misdemeanors; and was fined 2000 marks, imprisoned for a week, and bound to his good behaviour for three years. 1 Sid. 168. In times past, when any man granted a lease of his house, it was usual to insert an express covenant, that the tenant should not entertain any lewd women, &c.

LEVITE. In a general sense, means all the descendants of Levi, among whom were the Jewish priests themselves, who, being descended from Aaron, were likewise of the race of Levi. In a more particular sense, *Levite* is used for an order of officers in that church, who were employed in performing the manual service of the temple. They were obedient to the priests in their ministrations, and brought them wood, water, and other necessities for the sacrifice.—They sung and played upon instruments in the temple and in other places. They applied themselves to the study of the law, and were the ordinary judges of the country, but always subordinate to the priests. Their subsistence was the tithes of corn, fruit, and cattle, throughout Israel: but the priests were intitled to a tenth of their tithes, by way of first-fruits to the Lord. Eight and forty cities were assigned for the residence of the Levites, of which the priests claimed thirteen, six whereof were chosen for cities of refuge. They were consecrated, before they entered upon their ministry, by shaving their flesh, washing their cloaths, and sprinkling with the water of expiation. Imposition of hands was used in consecration, and two bullocks were offered at the door of the tabernacle. They waited weekly, and by turns, in the temple, beginning their attendance on one sabbath and ending the next: During this time they were maintained out of the offerings, &c. In the time of Solomon, the number of Levites, from the age of 20 and capable of serving, was 38,000.

LEVITICUS, a canonical book of the Old Testament, so called from its containing the laws and regulations relating to the priests, Levites, and sacrifices.

LEVITY, in physiology, the privation or want of weight in any body when compared with another that is heavier than it; in which sense it stands opposed to gravity.

LEUK, a town of Switzerland, almost in the middle of the Valais; remarkable for its natural strength, for the assembly of the states that often meet there, and for its baths, whose water is so hot that they will boil eggs.

LEUNCLAVIUS (Joannes), a learned German, was descended from a noble family, and born at Amelbrun in Westphalia, 1533. He travelled through almost all the countries in Europe. While he was in Turkey, he collected very good materials for an "History of the Ottoman Empire;" which he published, and also several other pieces concerning it, in Latin. He gave Latin translations also of Xenophon, Zosimus, &c. To a knowledge of the learned languages he added that of the civil law. He died at Vienna in 1593, aged 60.

LEUSDEN (John), a celebrated philologist, born in

Levite
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Leusden.

Leutkirk in 1624. He studied the learned languages and mathematics at Utrecht; and then went to Amsterdam, to converse with the rabbis, and perfect himself in the Hebrew tongue. After which he was professor of Hebrew at Utrecht, where he acquired a great reputation, and died in 1699. He wrote many valuable works; the principal of which are, 1. *Onomasticum Sacrum*, 8vo. 2. *Clavis Hebraica & Philologica Veteris Testamenti*, 4to. 3. *Novi Testamenti Clavis Græca, cum Annotationibus Philologicis*, 8vo. 4. *Compendium Bibliæ Veteris Testamenti*, 8vo. 5. *Compendium Græcæ Novi Testamenti*; the best edition of which is that of London, in 1668, 12mo. 6. *Philologus Hebraeus*, 4to. 7. *Philologus Hebraeus mixtus*, 4to. 8. *Philologus Hebraeus Græcus*, 4to. 9. Notes on Jonas, Joel, Hosea, &c. He also gave correct editions of several learned works.

LEUTKIRK, a free and imperial town of Germany, in Suabia, and in Algow, seated on a rivulet that falls into the Illar, in E. Long 10. 10. N. Lat. 47. 53.

LEUTMERITZ, a town of Bohemia, capital of a circle of the same name, with a bishop's see, seated on the river Elbe, in E. Long. 14. 25. N. Lat. 50. 34.

LEWARDEN, a handsome, rich, and strong town of the United Provinces, capital of Oostergow, Westergow, Sevenwolden, and West Friesland. It was the usual place of residence of the Stadtholder; and in buildings, as well public as private, is very magnificent. It has several canals running through the streets, which are of great service to their trade, especially as they are continued to the sea and to the most considerable towns of the province. E. Long. 5. 42. N. Lat. 53. 12.

LEEUEWENHOEK (Anthony de), a celebrated Dutch physician and naturalist, was born at Delft in 1632, of an ancient family of that city; and acquired a very great reputation throughout all Europe, by his experiments and discoveries. He particularly excelled in making glasses for microscopes and spectacles, and died in 1723. His letters to the royal society of London, of which he was a member, were printed at Leyden, in 1722, in 4to.

LEVY, in law, signifies to gather or collect; as to levy money, and to levy a fine of lands in the passing a fine.

LEWENTZ, a town of Upper Hungary, in the county of Gran, and on the river of the same name, where the Turks were defeated in 1644. E. Long. 18. 19. N. Lat. 48. 15.

LEWES, a large well-built town of Sussex in England, seated on an eminence on the banks of the river Ouse, 50 miles from London. It is famous for a bloody battle near it, wherein King Henry III. was defeated and taken prisoner by the barons; and is so ancient, that we read the Saxon king Athelstan appointed two mint-houses here, and that in the reign of Edward the Confessor it had 127 burgesses. It is a borough by prescription, by the style of constables and inhabitants. The constables are chosen yearly. It has handsome streets and two suburbs, with six parish churches. It carries on a good trade; and the river Ouse runs through it, which brings goods in boats and barges from a port 8 miles off. On this river are several iron-works, where cannon are cast for merchant-ships, besides other useful works. A charity-

school was opened here in 1711, where 20 boys are taught, clothed, and maintained, at the expence of a private gentleman, by whom they were also furnished with books; and 8 boys more are taught here at the expence of other gentlemen. Here are horse-races almost every summer for the king's plate of L. 100. The roads here are deep and dirty; but then it is the richest soil in this part of England. The market here is on Saturday; and the fairs May 6. Whitfun-Tuesday, and October 2. The timber of this part of the county is prodigiously large. The trees are sometimes drawn to Maidstone and other places on the Medway, on a sort of carriage called a *rag*, drawn by 22 oxen a little way, and then left there for other tugs to carry it on; so that a tree is sometimes two or three years drawing to Chatham; because, after the rain is once set in, it fits no more that year, and sometimes a whole summer is not dry enough to make the roads passable. It is cheap living here; and the town not being under the direction of a corporation, but governed by gentlemen, it is reckoned an excellent retreat for half-pay officers, who cannot so well confine themselves to the rules of a corporation. It lends two members to parliament.

LEWIS, one of the largest of the Hebrides or western islands of Scotland, extending about 60 miles in length from north to south, and from 13 to 14 in breadth, consisting of a great number of isles and rocks, and parted by the sea into two divisions, called *Lewis* and *Harrie*, the former lying to the westward of the other. Lewis belongs to the shire of Ross; is divided by several channels, distinguished by several names, and partitioned out among different proprietors; but the *Lewis*, strictly so called, stretches about 36 miles in length, from the north point of Bowling-head to the southern extremity of Kuffiness in Harries. The air is temperately cold, moist, and healthy; great part of the low ground is flooded with lakes; the rest is arable in many places, and has been counted fruitful in oats, barley, rye, flax, and hemp. The soil in these parts is a light sand, which the inhabitants manure with foot and sea-ware; but great part of the island is covered with heath. The labouring people dig the land with spades, and break the clods with small harrows, the foremost teeth of which are made of wood, and the remainder of rough heath, which smooths what the others have broken; and this harrow is drawn by one man, having a strong trace of horse-hair across his breast. Of their corn they not only make malt for ale, but likewise a strong spirit called *trifflarg*, which is the whisky, or usquebaugh, three times distilled. Lewis abounds with convenient bays and harbours, in which are caught, in great plenty, cod, ling, and herring: here are likewise whales of different sizes, which the natives drive into the bays, and kill with harpoons. These bays afford great plenty of shell-fish, such as clams, oysters, cockles, mussels, limpets, welks, and such a prodigious quantity of spout-fish is sometimes cast up from the land off Loch-tua, that they infect the air, and render it unhealthy to the neighbouring inhabitants, who are not able to consume them, either by eating, or using them as manure for the ground. Some of these lochs and bays likewise produce small coral and coralline. The fresh-water lakes are well stored with trout and eels, and the rivers

yield

Leutkirk
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Lewes

Lewis.

Lewis.

yield plenty of salmon. Along the coast are found a great number of caves, which serve as shelter for the seals and otters, which are also eaten as dainties by the inhabitants; and vast numbers of sea-fowl build upon the rocks and promontories.

The land-animals reared in this island, are cows, horses, sheep, goats, hogs, and deer; all these are of a diminutive size. The beef, mutton, and pork, are juicy and delicious; the horses are active and hardy: the deer, which are of the red kind, confine themselves to the chace of Ofervaul, about 15 miles in compass, which affords tolerable pasturage; but in the winter, when the ground is covered with frost and snow, these animals are forced to feed on sea-ware, and endure all the rigour of the season, without any shelter from wood or copse, for there is not a tree to be seen; nevertheless, the roots of very large trees, which have been cut by the ax, are found in different places. There is likewise a small grove of birch and hazle on the south-west side of Loch-Stornaway.

The inhabitants of Lewis are well-proportioned, tall, fair, sanguine, strong, and healthy. They are in general sober, circumspect, and hospitable; dexterous in shooting, swimming, and leaping; bold and skilful mariners; and so temperate, that they will tug at the oar all day, without any other provision than bread and water, with a snuff of tobacco.

Along this coast we see several natural mounts or forts, called *Dun*; such as Dun-rowly, Dun-coradel, and Dun-eisten. There are also the remains of some old castles, and other monuments of antiquity. At Stornaway village we see the ruins of a fortress destroyed by the English garrison sent thither by Oliver Cromwell. To the northward of Brago there is a round tower built of large stones, three stories high, tapering towards the top, with a double wall, and a circular staircase between, by which one may go quite round the building. On the heaths and summits of hills there are several cairns or heaps of stones, which served either for graves or beacons. In the parish of Barvas we see a single stone called the *thryshel*, standing upright, above 20 feet high, and almost as much in breadth. Three stones, about 12 feet high each, are seen standing on the north side of Loch-carlavy; and many others standing single at great distances, and in remote parts of the island. But the most remarkable monument of this kind appears by the village of Clafernish. Here we find 39 pyramidal stones standing upright, about six or seven feet high from the surface, each about two feet in breadth. They are placed in form of an avenue, eight feet wide; the distance between every stone amounting to six feet, and a single piece stands at the entrance. This avenue leads to a circle of 12 stones of the same dimensions, with one in the centre 13 feet in length, and shaped like a rudder: on the east, south, and west sides of this circle, are four stones, such as those that compose this round and avenue, forming three lines, or as it were rays from the body of the circle. This is supposed to have been a Druid temple; and tradition reports, that the chief Druid stood by the large stone in the centre, and harangued the audience. At the distance of a quarter of a mile there is another circle of the same nature; but without the range and avenue

Lewis.

In all probability, these, as well as the monuments we have described in our account of the Orkneys, and Stone-henge on Salisbury-plain, were places of worship erected by the Druids in time of Pagan superstition. The chief town in Lewis is called Stornaway.

There is a considerable number of inferior adjacent isles and rocks, some of which hardly deserve to be mentioned; such as the small island Garve at the mouth of Loch Carlavy, Berinsay, Fladda, Bernera Minor, and Bernera Major, Kiallisy, Cayay, Carvay, Grenim, Pabay, Shirem, Vexay, Wuya the Larger and Lesser, and the Flannan islands, which the seamen denominate the *northern hunters*. These are visited every summer by the inhabitants of the Lewis, who go thither in quest of fowls, eggs, down, quills, and feathers, as well as to shear or kill the sheep that are kept here for pasture. As these islands are very steep and rocky, the visitors, after having landed and climbed up the rock by a ladder, uncover their heads, and, making a turn sun-ways, thank God for having escaped the danger they have undergone. In the largest island are the ruins of a chapel dedicated to St Flannan, from whom the isles derive their name. Thither the fowlers repairing, strip themselves of their upper garments, which being laid upon a stone, they advance towards the altar, and repeat three prayers; an exercise which is performed every morning and evening. They observe many other superstitious customs during their residence on these rocks; and when they have landed their boat with their purchase, return to the larger islands. Among the islands belonging to the Lewis, we may likewise take notice of the small isle of Pigmies, so called, because bones resembling those of human creatures, but of very small dimensions, have been dug out of the ground.

The island of Lewis is divided into the two parishes of Barvas and Eye, and in each of these one minister is settled; but there is a great number of churches and chapels dedicated to different saints, in the different isles which compose this cluster. All these were sanctuaries before the reformation, but now they are divested of that privilege. The people of these islands are Presbyterians, with a few Protestants of the English communion, and a still smaller number of Roman Catholics. The Protestants observe the festivals of Christmas, Good Friday, Easter, and Michaelmas; on the last of which the individuals of both sexes perform an anniversary cavalcade.

LEWIS, or LOUIS, the name of several kings of France. See ERANCE.

LEWIS VII. anno 1137, was the first who had the courage to oppose the encroachments of the popes on the regal authority: Pope Innocent II. excommunicated him for appointing an archbishop of Bourges; but Lewis defended his prerogatives, and put the priests to death who had been the authors of the quarrel. In 1147, he put himself at the head of an army of 80,000 men, and marched against the Saracens, in the second crusade, but was defeated; and returning into France by sea, was taken by the Greeks, but rescued by Roger king of Sicily. His queen Eleonora accompanied him in this expedition; and being suspected of infidelity with Saladin, a young Turk,

Lewis.

Lewis.

Lewis divorced her, and she was married six weeks after to Henry duke of Normandy, (Henry II. king of England). Lewis died in 1180, aged 60.

Lewis IX. anno 1226 (canonized), was one of the greatest monarchs of France; equally memorable for his valour and his virtues, but unfortunately misled by the superstition of the times: he sacrificed his own repose, and the welfare of his kingdom, to the folly of crusading. In 1248, leaving France to the care of his mother, he embarked for Egypt, attended by his queen, his three brothers, and the flower of the French nobility. At first his victories were rapid: he took Damietta in 1249; but the following year he was defeated and taken prisoner by the Turks, with all the nobility in his train, and the greatest part of his army. The sultan sent to him in prison, to demand an exorbitant sum for his ransom; and his answer being truly noble, deserves to be recorded: "Tell the sultan, that a king of France is not to be ransomed with money; I will give the sum required for my people, and Damietta for myself." These terms were accepted, and a peace of ten years ensued. Upon his return to France, he diminished the taxes, revoked those which the cupidity of the financiers had introduced; issued several salutary edicts; founded several churches and hospitals; and effectually overturned the ecclesiastical jurisdiction of the court of Rome, by his pragmatic sanction in 1269, which established the independency of the Gallican church. Thirteen years residence in his capital indemnified his subjects for his absence; but his pious zeal prevented the enjoyment of this happiness: he embarked for the sixth crusade in 1270; and died the same year, at the siege of Tunis, aged 55.

Lewis XI. anno 1461. His oppressions obliged his subjects to enter into a league against him, styled "*Ligue de bien public*," in which his brother the duke of Berri and some of the principal nobility were concerned: they solicited succours from John duke of Calabria, who joined them with 500 Swifs (the first introduction of Swifs soldiers into the French armies.) His reign was almost one continued scene of civil war; and it is computed that 4000 of his subjects were executed in public and privately, either for being in arms against him, or suspected by him. In his last illness, he drank the warm blood of children, in the vain hope of restoring his decayed strength. He died in 1483, aged 60. The posts for letters were established in his reign, owing to his eagerness for news; the first institution of this nature in Europe.

Lewis XII. anno 1492, styled the *Just*, and the *Father of his people*; memorable for his valour in the field, and his wisdom in the cabinet. A great general; but unfortunate towards the end of his reign, when he did not command his troops in person: his orders transmitted from home were misunderstood, or wilfully disobeyed; and he had the mortification, before he died, to see the total expulsion of the French from the possessions he had acquired for them by his personal bravery. At 53 years of age, he married the princess Mary of England, sister of Henry VIII. and being of a delicate constitution, fell a victim (according to the French historians) to amorous dalliance; for he died in about two months after his nuptials, in 1515.

Lewis XIII. anno 1610, increased the military reputation of his country, and made considerable additions to its domains. The beginning of his reign was occupied in civil wars with his mother and his Protestaut subjects; in which he was excited to continue by his famous minister cardinal Richelieu, who attended him to the siege of Rochelle, the bulwark of the Huguenot party. This place was reduced by famine to surrender, in 1628, after a siege of more than a year. Upon this and other occasions, the king gave proofs of great personal bravery. His attachment to his ally the duke de Nevers, who succeeded to the duchy of Mantua, but was refused the investiture by Charles VI. emperor of Germany, involved him in a war with that prince, the Spaniards, and the duke of Savoy; in which Lewis was victorious; and obtained a treaty of peace, by which the duke of Mantua was guaranteed in the possession of his dominions. In 1635, a new war broke out between France and Spain, and the emperor took part with the latter: it lasted 13 years against the emperor, and 25 against Spain, with various success; and the different armies kept on foot, in the Low Countries, on the frontiers of France, and in Italy, in the first years of this war, paved the way for the signal successes of Lewis XIV. the campaigns of these armies being a military school of discipline and experience for the French officers, besides giving them a knowledge of the countries which became the seat of war in the next reign. Lewis XIII. died 1643, aged 41.

Lewis XIV. le Grand (king at five years of age), anno 1643. He was at first styled *Dieu-donne*, because the French considered him as the gift of heaven, granted to their prayers after the queen had been barren 22 years. This princess (Anne of Austria) was declared regent by Lewis XIII. and saw herself under a necessity to continue the war against Philip IV. king of Spain, her brother. The duke d'Enguin was made general of the French armies; and so signal was the success of this renowned warrior (afterwards prince of Condé, and known by the style of the *Great Condé*), that his victories brought on the advantageous treaties of Munster in 1648, between France, the emperor Ferdinand III. and Christina queen of Sweden: the basis of the aggrandisement of France in this reign; the principal events of which, and of the next, are related under the articles *BRITAIN, UNITED PROVINCES, &c.* Lewis XIV. died in 1715, aged 77.

Lewis XV. (his great-grandson) succeeded in 1715. He was styled, in the course of his reign, the *well beloved*, which he lost some years before he died; and was detested and despised by his subjects for his shameful attachment to a young girl, under the title of his *mistress*, who, by the ministry of her patron the duke d'Aiguillon, governed the kingdom, and invaded the ancient rights and privileges of the people. He died in 1774, in the 64th year of his age and 59th of his reign.

LEXINGTON, a town of North America, and capital of Kentucky. It stands on the head waters of Elkhorn river, is reckoned the capital of Kentucky. Here the courts are held, and business regularly conducted. In 1786, it contained about 100 houses and several stores, with a good assortment of dry goods. It must have greatly increased since.

LEX, LAW. See LAW.—The Roman laws were of

Lewis.

Lex.

of three kinds: 1st, Such as were made by their kings. 2d, The laws of the twelve tables brought by the *Decemviri* from Athens, &c. And, 3d, Such as were proposed by the superior magistrates in the times of the republic. The laws of this last class were enacted in the following manner.

No law could be proposed but by some of the following magistrates, viz. the *Prator*, the *Consuls*, the *Didactor*, the *Interrex*, the *Decemviri*, the *Military Tribunes*, *Triumviri*, and *Tribunes* of the people. If any of these proposed a law, it was first committed to writing, and privately examined as to its utility and probable consequences, by some persons well qualified for the task; sometimes it was referred to the whole senate for their sentiments. It was then hung up publicly for three market-days, that all the people might have time to examine it, and consider its tendency: This was called *legis promulgatio*, *quasi promulgatio*. If the person who framed the bill did not see cause in the mean time to drop it, the people were convened in *comitia*, and he addressed them in an oration, being also seconded by his friends, setting forth the expediency and probable utility of such a law: This was called *rogatio legis*, because the address was always prefaced with this petitionary form of words, *Vultis iubeatisne, Quirites?* "Will you, O Romans, consent and order this law to pass?" This being done, those that disliked the motion delivered their sentiments in opposition to it. An urn was then brought to certain priests who attended upon the occasion, into which were cast the names of the tribes, centuries, or *curia*, as the *comitia* happened to be *tributa*, *centuriata*, or *curiata*. The names were shaken together; and the first drawn tribe or century was called *prærogativa*, because their suffrages were first taken. The *curia* that was first drawn was called *principium* for the same reason. The other tribes, centuries, &c. were called *tribus jure vocata*, *centuria jure vocata*, &c.

Matters being in this situation, the *velo* or negative voice of the tribunes of the people might put an entire end to the proceedings, and dissolve the assembly. The tribune's interference was called *intercessio*. The consul also had it in his power to stop further proceedings, by commanding any of the holidays called *ferie imperatorie* to be observed. The *comitia* would of course be dissolved also by any of the persons present being seized with the falling-sickness, or upon the appearance of any unlucky omen. But supposing the business to meet with no interruption of this sort, the people were each of them presented with two tablets, on one of which was written in large characters A. on the other U. R. Their disapprobation of the bill was expressed by throwing into an urn the tablet inscribed A. signifying "I forbid it," *antiquo*, "I prefer the old." Their assent was signified by throwing in the tablet marked U. R. i. e. *uti rogas*, "be it as you desire." According to the majority of these tablets the law passed or not. If it passed, it was written upon record, and carried into the treasury; this was called *legem ferre*. Afterwards it was engraved upon plates of brass, and hung up in the most public and conspicuous places: this was termed *legem figere*, and a future repeal of this law was *legem rescire*.

If a law passed in the *comitia curiata*, it was called
Vol. X. Part I.

lex curiata; if in the *comitia centuriata*, it had the name of *lex centuriata*; but if it passed in the *comitia tributa*, it was termed *plebiscitum*. The laws, too, generally bore the names of the proposers, as *lex Ælia*, *lex Folia*, &c.

Romulus used to make laws by his own single authority, but succeeding kings fought the approbation of the people.

LEXIARCHI, at Athens, six officers assisted by 30 inferior ones, whose business it was to lay fines upon such as came not to the public assemblies, and also to make scrutiny among such as were present.

The *lexiarchi* kept a register of the age, manners, and abilities of all the citizens, who were always enrolled at the age of 20.

LEXICON, the game with dictionary. The word is chiefly used in speaking of Greek dictionaries: it is derived from the Greek *λέγειν*, word, *dictio*; of *λέγω* I speak.

LEYDEN, in Latin *Lugdunum Batavorum*, one of the largest and finest cities in Holland, abounds with canals, along which are rows of lofty trees that afford very pleasant walks. An arm or small branch of the Rhine runs through it. Over the canals are 145 bridges, most of them of stone or brick. The university here is the oldest in the United Provinces: it has large privileges; a library well furnished, and particularly rich in manuscripts; a physic-garden well stocked with all sorts of plants, many of which have been brought from the Cape of Good Hope and the East Indies; an anatomy-hall, well provided with skeletons; and an observatory. The professors, who are generally very eminent, read public lectures four times a week, for which they take no money, but about three guineas are paid for a course of private lectures, which lasts a whole year. The students have no distinct habit, but all wear swords, though they generally go to the public and private lectures in their night-gowns and slippers. The salaries of the professors are from 100*l.* to 200*l.* a-year: they wear gowns only when they preside at public disputations, read public lectures, or meet in the senate; and their lectures are always in Latin. The students do not lodge in the university, but where they please in the town. The cloth manufacture here is much decayed, which formerly flourished to such a degree, that 100,000 pieces, it is said, have sometimes been made in a year. The city is famous for the long and severe siege it maintained in 1573 against the Spaniards. We cannot help mentioning the reply of that illustrious magistrate, Adrian de Voss, when the citizens represented to him the havoc made by the famine during the siege, and insisted upon his surrendering: "Friends (said he), here is my body, divide it among you to satisfy your hunger, but banish all thoughts of surrendering to the cruel and perfidious Spaniard." They took his advice, in regard to their not surrendering, and never would listen to any overtures; but told the Spaniards, they would hold out as long as they had one arm to eat and another to fight. There are some fine churches here, and many long, broad, handsome, streets; but the Papists, as at Haerlem, are more numerous than the Protestants.

LEYDEN Phial, a phial coated on the inside and outside with tinsol, or other proper conducting substance,
C. and

Lexiarchi
Leyden.

LEYERA
||
Lhuyd.

and furnished with a brass wire and knob, for giving the electrical shock. See *ELECTRICITY-Index*.

LUCAS was *LEYDEN*. See *LUCAS*.

LEYERA, in botany: A genus of the polygamia superflua order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The receptacle is naked; the pappus paleaceous; that of the disc plumy; the calyx scarious.

LEYTE, one of the Philippine islands in the East Indies, situated in E. Long. 118. O. N. Lat. 11. O. Its greatest length is about 40 leagues, and its circumference about 90 or 100. Its soil on the east side is very fruitful; but there are very high mountains which cut it almost through the middle, and occasion so great an alteration in the air, that when it is winter on the north side, it is summer on the southern part of the island. Thus when the inhabitants of one half of the island reap, the others sow; and they have two plentiful harvests in a year, to which the rivers running down from the abovementioned mountains contribute not a little. The island contains about 9000 inhabitants, who pay tribute to the Spaniards in rice, wax, and quilts.

LHUYD, or **LHOYD** (Humphrey), a learned antiquarian of the 16th century, born at Denbigh, who applied himself to the study of physic; and living mostly within the walls of Denbigh castle, practised there as a physician; and died in 1570, with the character of a well-bred gentleman. He wrote and translated several pieces relative to history and antiquities; in particular, The history of Cambria, now called *Wales*, from Cardoc of Llangarvan, &c. but died before it was finished; however, Sir Henry Sidney, lord president of Wales, employed Dr David Powel to finish it, who published it in 1584. A new and improved edition of this work was published in 1774.

LHUYD (Edward), keeper of the Museum at Oxford, was a native of South Wales, the son of Charles Lhuyd, Esq; of Llanvorde. He was educated at Jesus College, Oxford, where he was created M. A. July 21. 1701. He was bred under Dr Plot, whom he succeeded as keeper of the Ashmolean museum, and had the use of all Vaughan's collections. With incessant labour and great exactness he employed a considerable part of his life in searching into the Welsh antiquities; had perused or collected a great deal of ancient and valuable matter from their MSS.; transcribed all the old charters of their monasteries that he could meet with; travelled several times over Wales, Cornwall, Scotland, Ireland, Armoric Bretagne, countries inhabited by the same people, compared their antiquities, and made observations on the whole; but died in July 1709, before he had digested them into the form of a discourse, as he intended, on the ancient inhabitants of this island. The untimely death of this excellent antiquary prevented the completing of many admirable designs. For want of proper encouragement, he did very little towards understanding the British bards, having seen but one of those of the sixth century, and not being able to procure access to two of the principal libraries in the country. He communicated many observations to Bishop Gibson, whose edition of the *Britannia* he revised; and published "*Archæologia Britannica*, giving some ac-

Lhuyd
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Libanius.

count additional to what has been hitherto published of the languages, histories, and customs of the original inhabitants of Great Britain, from collections and observations in travels through Wales, Cornwall, Bas Bretagne, Ireland, and Scotland, Vol. I. Glossography, Oxford 1707," fol. He left in MS. a Scottish or Irish-English Dictionary, proposed to be published in 1732 by subscription, by Mr David Malcolm, a minister of the church of Scotland, with additions; as also the Elements of the said language; with necessary and useful informations for propagating more effectually the English language, and for promoting the knowledge of the ancient Scottish or Irish, and very many branches of useful and curious learning. Lhuyd, at the end of his preface to the *Archæologia*, promises an historical dictionary of British persons and places mentioned in ancient records. It seems to have been ready for press, though he could not set the time of publication. His collections for a second volume, which was to give an account of the antiquities, monuments, &c. in the principality of Wales, were numerous and well chosen; but, on account of a quarrel between him and Dr Wynne, then fellow, afterwards principal of the college, and bishop of St Asaph, he refused to buy them, and they were purchased by Sir Thomas Seabright, of Beachwood in Hertfordshire, in whose library the greatest part still remain, but so indigested, and written with so many abbreviations, that nobody can undertake to publish them. They consist of about 49 volumes in folio, 10 in quarto, and above 100 smaller, and all relate to Irish or Welsh antiquities, and chiefly in those languages. Carte made extracts from them about or before 1736; but these were chiefly historical. Sir John Seabright has given Mr Pennant 23 of Lhuyd's MSS. Latin and English. Many of his letters to Lister, and other learned contemporaries, were given by Dr Fothergill to the university of Oxford, and are now in the Ashmolean museum. Lhuyd undertook more for illustrating this part of the kingdom than any one man besides ever did, or than any one man can be equal to.

LIBANIUS, a famous Greek rhetorician and sophist in the 4th century, was born at Antioch, and had a great share in the friendship of Julian the Apostate. That prince offered him the dignity of *Præficus Prætorio*; but Libanius refused it, thinking the name of *sophist*, or *professor of eloquence*, much more honourable. There are still extant several of his letters and Greek orations, by which he acquired great reputation; but his style is somewhat affected and obscure. He was a pagan. Basil and Chrysostom were his disciples about the year 360. His letters were published at Amsterdam in 1738; his orations at Venice, 1755.

LIBANOMANTIA, in antiquity, a species of divination performed with frankincense; which, if it presently caught fire, and sent forth a grateful odour, was esteemed a happy omen, and *vice versa*.

LIBANUS, the name of a chain of mountains of Turkey in Asia, which lie between Proper Syria and Palestine, extending from west to east, from the Mediterranean sea as far as Arabia. The summits of these mountains are so high, that they are always covered with snow; but below are very pleasant, and fruitful.

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fruitful valleys. They were formerly famous for the great number of cedar-trees growing thereon; but now there are very few remaining. Geographers distinguish this chain into Libanus and Antilibanus; the latter of which lies on the south side of the valley, rising near the ruins of Sidon, and terminates at others in Arabia, in N. Lat. 34. They are separated from each other at an equal distance throughout; and form a basin, or country, called by the ancients *Celo Syria*.

LIBATION, amongst the Greeks and Romans, was an essential part of solemn sacrifices. It was also performed alone, as a drink offering, by way of procuring the protection and favour of the gods, in the ordinary affairs of life. Libations, according to the different natures of the gods in honour of whom they were made, consisted of different liquids, but wine was the most usual. The wine offered to the gods was always unmixed with water. We meet with libations of water, libations of honey, libations of milk, and libations of oil; these are called *σπονδαίαια*. The libation was made with a serious deportment and solemn prayer. At sacrifices, the libation, after it had been tasted by the priest, and handed to the bystanders, was poured upon the victim. At entertainments, a little wine was generally poured out of the cup, before the liquor began to circulate, to show their gratitude to the gods for the blessings they enjoyed.

Libations were also in use among the Hebrews, who poured an hin of wine on the victim after it was killed, and the several pieces of the sacrifice were laid on the altar, ready to be consumed in the flames.

LIBAW, a sea-port town of Courland, lying on the Baltic sea, consisting entirely of wooden houses. It belongs to the duke of Courland, and is situated in E. Long. 21. 27. N. Lat. 56. 27.

LIBEL, (*libellus famosus*), taken in its largest and most extensive sense, signifies any writing, picture, or the like, of an immoral or illegal tendency; but, in a peculiar sense, is used to denote a malicious defamation of any person, and especially a magistrate, made public by either printing, writing, signs or pictures, in order to provoke him to wrath, or expose him to public hatred, contempt, and ridicule. The direct tendency of these libels is the breach of the public peace, by stirring up the objects of them to revenge, and perhaps to bloodshed. The communication of a libel to any one person is a publication in the eye of the law: and therefore the sending an abusive private letter to a man is as much a libel as if it were openly printed, for it equally tends to a breach of the peace.

With regard to libels in general, there are, as in many other cases, two remedies; one by indictment, and another by action. The former for the public offence; for every libel has a tendency to break the peace, or provoke others to break it: which offence is the same whether the matter contained be true or false; and therefore the defendant, on an indictment for publishing a libel, is not allowed to allege the truth of it by way of justification. But in the remedy by action on the case, which is to repair the party in damages for the injury done him, the defendant may, as for words spoken, justify the truth of the facts, and show that the plaintiff has received no injury at all. What was said with regard to words spoken, will also

hold in every particular with regard to libels by writing or printing, and the civil actions consequent thereupon: but as to signs or pictures, it seems necessary always to show, by proper innuendoes and averments of the defendant's meaning, the import and application of the scandal, and that some special damage has followed; otherwise it cannot appear, that such libel by picture was understood to be levelled at the plaintiff, or that it was attended with any actionable consequences.

In a civil action, then, a libel must appear to be false, as well as scandalous; for, if the charge be true, the plaintiff has received no private injury, and has no ground to demand a compensation for himself, whatever offence it may be against the public peace: and therefore, upon a civil action, the truth of the accusation may be pleaded in bar of the suit. But, in a criminal prosecution, the tendency which all libels have to create animosities, and to disturb the public peace, is the sole consideration of the law. And therefore, in such prosecutions, the only points to be considered are, first, the making or publishing of the book or writing; and, secondly, whether the matter be criminal: and, if both these points are against the defendant, the offence against the public is complete. The punishment of such libellers, for either making, repeating, printing, or publishing the libel, is a fine, and such corporal punishment as the court in its discretion shall inflict; regarding the quantity of the offence, and the quality of the offender. By the law of the twelve tables at Rome, libels, which affected the reputation of another, were made a capital offence: but, before the reign of Augustus, the punishment became corporal only. Under the emperor Valentinian it was again made capital, not only to write, but to publish, or even to omit destroying them. Our law, in this and many other respects, corresponds rather with the middle age of Roman jurisprudence, when liberty, learning, and humanity, were in their full vigour, than with the cruel edicts that were established in the dark and tyrannical ages of the ancient decemviri, or the latter emperors.

In this, and other instances, where blasphemous, immoral, treasonable, schismatical, seditious, or scandalous libels are punished by the English law, some with a greater, others with a less degree of severity; the *liberty of the press*, properly understood, is by no means infringed or violated. See *LIBERTY of the Press*.

LIBELLA, a piece of money amongst the Romans, being the tenth part of the denarius, and equal in value to the as. It was called *libella*, as being a little pound, because equal to a pound of brass. Its value in our money is 1 ob. 1 qu. or a half-penny farthing. See *MONEY*.

LIBELLA, or *Libellula*, in zoology, a genus of four-winged flies, called in English *dragon flies*, or *adder flies*; the characters of which are these: The mouth is furnished with jaws: the feelers are shorter than the breast; and the tail of the male terminates in a kind of hooked forceps. There are 21 species, chiefly distinguished by their colour. They have all two very large and reticulated eyes, covering the whole surface of the head. They fly very swiftly; and prey upon the wing, clearing the air of innumerable

Plate
 CCLXXIV

L'belli,
Liber.

able little flies. They are found in August and September in our fields and gardens, especially near places where there are waters, as they have their origin from worms living in that element. The great ones usually live all their time about waters; but the smaller are common among hedges, and the smallest of all frequent gardens. The smaller kind often settle upon bushes, or upon the ground; but the large ones are almost always upon the wing, so that it is very difficult to take them. Their eyes are beautiful objects for the microscope. The largest species is produced from a water-worm that has six feet, which, yet young and very small, is transformed into a chrysalis, that has its dwelling in the water. People have thought they discovered there to have gills like fishes. It wears a mask as perfectly formed as those that are worn at a masquerade; and this mask, fastened to the insect's neck, and which it moves at will, serves it to hold its prey while it devours it. The period of transformation being come, the chrysalis makes to the water-side, undertakes a voyage in search of a convenient place; fixes on a plant, or sticks fast to a bit of dry wood. Its skin, grown parched, splits at the upper part of the thorax. The winged insect issues forth gradually, throws off its slough, expands its wings, flutters, and then flies off with gracefulness and ease. The elegance of its slender shape, the richness of its colours, the delicacy and resplendent texture of its wings, afford infinite delight to the beholder. The sexual parts of the libellule are differently situated in the male and female. It is under the body at the joining of the thorax, that those parts are discovered in the males: those of the females are known by a slit placed at the extremity of the body. Their amours conclude in a rape. The male, while hovering about, watches, and then seizes the female by the head with the pincers with which the extremity of his tail is armed. The ravisher travels thus through the air, till the female yielding to superior strength, or rather to inclination, forms her body into a circle that terminates at the genitals of the male, in order to accomplish the purpose of nature. These kind of rapes are common. Libellule are seen thus coupled in the air, exhibiting the form of a ring. The female deposits her eggs in the water, from whence spring water-worms, which afterwards undergo the same transformations.

LIBELLI, was the name given to the bills which were put up amongst the Romans, giving notice of the time when a show of gladiators would be exhibited, with the number of combatants, and other circumstances. This was called *munus pronunciare* or *proponere*.—These bills were sometimes termed *edicta*. These public notices were given by the person who designed to oblige the people with the show, and were frequently attended with pictures representing the engagement of some celebrated gladiators. This custom is alluded to by Horace, lib. ii. sat. vii. v. 96, &c.

There was also the *fameus libellus*, a defamatory libel. Seneca calls them *contumeliosi libelli*, infamous rhymes, which by a Roman ordinance were punishable with death. Libellus also in the civil law signifies the declaration, or state of the prosecutor's charge against the defendant; and it has the like signification in our spiritual courts.

LIBER, in vegetables, the bark or rind, princi-

pally of trees. This is to be conceived as consisting of a number of cylindric and concentric surfaces whose texture is reticular, and in some trees plainly extrusible every way, by reason that the fibres are soft and flexible. While in this condition, they are either hollow regular canals, or, if not so, they have interstitial spaces which serve the office of canals. The nutritious juice which they are continually receiving, remains in part in them; makes them grow in length and thickness, and strengthens and brings them closer together; and by this means the texture which was before reticular becomes an assemblage of straight fibres ranged vertically and parallel to each other; that is, as they are thus altered behind one another, they by degrees become a new substance, more woody, called *blea*.

LIBERA, in mythology, the name of a goddess, which Cicero, in his book Of the Gods, represents as the daughter of Jupiter and Ceres. Ovid in his *Fasts* says that the name was given by Bacchus to Ariadne.

Libera is exhibited on medals as a kind of female Bacchus, crowned with vine leaves.

LIBERAL ARTS, are such as depend more on the labour of the mind than on that of the hands; or, that consist more in speculation than operation; and have a greater regard to amusement and curiosity than to necessity.

The word comes from the Latin *liberalis*, which among the Romans, signified a person who was not a slave; and whose will, of consequence, was not checked by the command of any master.

Such are grammar, rhetoric, painting, sculpture, architecture, music, &c. The liberal arts used formerly to be summed up in the following Latin verse: *Lingua, Tropus, Ratio, Numerus, Tonus, Angulus, Astra*. And the mechanical arts, which, however, are innumerable, under this:

Rus, Nemus, Arma, Faber, Vulnera, Luna, Rater.

See **ARTS**.

LIBERALIA, feasts celebrated by the ancient Romans, in honour of Liber or Bacchus, the same with those which the Greeks called *DIONYSIA*, and *Dionysia*.

They took their name from *liber*, i. e. *free*, a title conferred on Bacchus in memory of the liberty or freedom which he granted to the people of Bœotia; or, perhaps, because wine, whereof he was the reputed deity, delivers men from care, and sets their mind at ease and freedom. Varro derives the name of this feast from *liber*, considered as a noun adjective; and signifying *free*; because the priests were free from their function, and eased of all care, during the time of the *liberalia*: as the old women officiated in the ceremonies and sacrifices of these feasts.

LIBERIA, in Roman antiquity, a festival observed on the 16th of the kalends of April, at which time the youth laid aside their juvenile habit for the toga virilis, or habit peculiar to grown men. See the article **TOGA**.

LIBERTINES, **LIBERTINI**, in ecclesiastical history, a religious sect, which arose in the year 1525, whose principal tenets were, that the Deity was the sole operating cause in the mind of man, and the immediate author of all human actions; that, consequently, the distinctions of good and evil, which had been established with regard to those actions, were false and groundless, and

Libera
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Libertines.

Libertines, and that men could not, properly speaking, commit sin; that religion consisted in the union of the spirit or rational soul with the Supreme Being; that all those who had attained this happy union, by sublime contemplation and elevation of mind, were then allowed to indulge, without exception or restraint, their appetites or passions; that all their actions and pursuits were then perfectly innocent; and that, after the death of the body, they were to be united to the Deity. They likewise said that Jesus Christ was nothing but a mere *je ne sçai quoi*, composed of the spirit of God, and of the opinion of men.

These maxims occasioned their being called *Libertines*; and the word has been used in an ill sense ever since.

The *Libertini* spread principally in Holland and Brabant. Their leaders were one Quintin, a Picard, Pockefius, Ruffius, and another called Chopin, who joined with Quintin, and became his disciple.

This sect obtained a certain footing in France thro' the favour and protection of Margaret, queen of Navarre, and sister to Francis I. and found patrons in several of the reformed churches. This sect was probably a remnant of the more ancient Beguards or Brethren of the Free Spirit.

LIBERTINES of Geneva, were a cabal of rakes rather than of fanatics; for they made no pretences to any religious system, but pleaded only for the liberty of leading voluptuous and immoral lives. This cabal was composed of a certain number of licentious citizens, who could not bear the severe discipline of Calvin, who punished with rigour not only dissolute manners, but also whatever bore the aspect of irreligion and impiety. In this turbulent cabal there were several persons who were not only notorious for their dissolute and scandalous manner of living, but also for their atheistical impiety, and contempt of all religion. To this odious class belonged one Gruet, who denied the divinity of the Christian religion, the immortality of the soul, the difference between moral good and evil, and rejected with disdain the doctrines that are held most sacred among Christians; for which impieties he was at last brought before the civil tribunal, in the year 1550, and condemned to death. The Genevan spirit of reformation, improperly directed by the violence and zeal of Calvin, did at this time operate to a degree which has marked the character of this great reformer with reproach. For in 1544, Sebastian Castillo, master of the public school at Geneva, who was a man of probity, and distinguished by his learning and taste, was, nevertheless, deposed from his office and banished the city, because he disapproved some of the measures that were pursued and some of the opinions entertained by Calvin and his colleagues, and particularly that of absolute and unconditional predestination. Jerome Bolsee also, a man of genius and learning, who became a convert to the Protestant religion and fled to Geneva for protection, was cast into prison, and soon after sent into banishment, because, in 1551, he imprudently and inconsiderately declaimed, in full congregation and at the close of public worship, against the doctrine of absolute decrees.

LIBERTUS, or **LIBERTINUS**, among the Romans, a freedman, or a person set free from a legal servitude.

These still retained some mark of their ancient state: he who made a slave free having a right of patronage over the *libertus*; so that if the latter failed of showing due respect to his patron, he was restored to his servitude; and if the *libertus* died without children, his patron was his heir. See **SLAVE**.

In the beginning of the republic, *libertinus* denoted the son of a *libertus* or freedman; but afterwards, before the time of Cicero, and under the emperors, the terms *libertus* and *libertinus*, as Suetonius has remarked, were used as synonymous.

LIBERTY, denotes a state of freedom, in contradistinction to *slavery* or *restraint*; and may be considered as either *natural* or *civil*.

The absolute rights of man, considered as a free agent, endowed with discernment to know good from evil, and with power of choosing those measures which appear to him to be most desirable, are usually summed up in one general appellation, and denominated the *natural liberty of mankind*. This natural liberty consists properly in a power of acting as one thinks fit, without any restraint or controul, unless by the law of nature; being a right inherent in us by birth, and one of the gifts of God to man at his creation, when he endued him with the faculty of free-will. But every man, when he enters into society, gives up a part of his natural liberty, as the price of so valuable a purchase; and, in consideration of receiving the advantages of mutual commerce, obliges himself to conform to those laws which the community has thought proper to establish. And this species of legal obedience and conformity is infinitely more desirable than that wild and savage liberty which is sacrificed to obtain it. For no man, that considers a moment, would wish to retain the absolute and uncontrouled power of doing whatever he pleases: the consequence of which is, that every other man would also have the same power; and then there would be no security to individuals in any of the enjoyments of life.

Political, therefore, or *civil*, liberty, which is that of a member of society, is no other than natural liberty, so far restrained by human laws (and no farther) as is necessary and expedient for the general advantage of the public. Hence we may collect, that the law, which restrains a man from doing mischief to his fellow citizens, though it diminishes the natural, increases the civil liberty of mankind: but every wanton and causeless restraint of the will of the subject, whether practised by a monarch, a nobility, or a popular assembly, is a degree of tyranny. Nay, that even laws themselves, whether made with or without our consent, if they regulate and constrain our conduct in matters of mere indifference, without any good end in view, are laws destructive of liberty: whereas, if any public advantage can arise from observing such precepts, the controul of our private inclinations, in one or two particular points, will conduce to preserve our general freedom in others of more importance, by supporting that state of society which alone can secure our independence. Thus the statute of king Edward IV. which forbade the fine gentlemen of those times (under the degree of a lord) to wear pikes upon their shoes or boots of more than two inches in length, was a law that favoured of oppression; because, how-

Liberty.

ever ridiculous the fashion then in use might appear, the restraining it by pecuniary penalties could serve no purpose of common utility. But the statute of King Charles II. which prescribes a thing seemingly as indifferent, *viz.* a dress for the dead, who were all ordered to be buried in woollen, is a law consistent with public liberty; for it encourages the staple trade, on which in great measure depends the universal good of the nation. So that laws, when prudently framed, are by no means subversive, but rather introductive, of liberty; for (as Mr Locke has well observed) where there is no law there is no freedom. But then, on the other hand, that constitution or frame of government, that system of laws, is alone calculated to maintain civil liberty, which leaves the subject entire master of his own conduct, except in those points wherein the public good requires some direction or restraint.

The idea and practice of this political or civil liberty flourish in their highest vigour in these kingdoms, where it falls little short of perfection, and can only be lost or destroyed by the folly or demerits of its owner; the legislature, and of course the laws of Britain, being peculiarly adapted to the preservation of this inestimable blessing even in the meanest subject. Very different from the modern constitutions of other states on the continent of Europe, and from the genius of the imperial law; which in general are calculated to vest an arbitrary and despotic power, of controuling the actions of the subject, in the prince, or in a few grandees. And this spirit of liberty is so deeply implanted in our constitution, and rooted even in our very soil, that a slave or a negro, the moment he lands in Britain, falls under the protection of the laws, and so far becomes a freeman; though the master's right to his service may possibly still continue.

The absolute rights of every Briton (which, taken in a political and extensive sense, are usually called their *liberties*), as they are founded on nature and reason, so they are covel with our form of government; though subject at times to fluctuate and change, their establishment (excellent as it is) being still human. At some times we have seen them depressed by overbearing and tyrannical princes; at others, so luxuriant as even to tend to anarchy, a worse state than tyranny itself, as any government is better than none at all. But the vigour of our free constitution has always delivered the nation from these embarrassments: and, as soon as the convulsions consequent on the struggle have been over, the balance of our rights and liberties has settled to its proper level; and their fundamental articles have been from time to time asserted in parliament, as often as they were thought to be in danger:

First, by the great charter of liberties, which was obtained, sword in hand, from King John, and afterwards, with some alterations, confirmed in parliament by King Henry III. his son. Which charter contained very few new grants; but, as Sir Edward Coke observes, was for the most part declaratory of the principal grounds of the fundamental laws of England. Afterwards, by the statute called *confirmatio cartarum*, whereby the great charter is directed to be allowed as the common law; all judgments contrary to it are declared void; copies of it are ordered to be sent to all cathedral churches, and read twice a-year to the people; and sentence of excommunication is directed to

be as constantly denounced against all those that by word, deed, or counsel, act contrary thereto, or in any degree infringe it. Next by a multitude of subsequent corroborating statutes (Sir Edward Coke reckons 32), from the first Edward to Henry IV. Then, after a long interval, by the *petition of rights*; which was a parliamentary declaration of the liberties of the people, assented to by King Charles I. in the beginning of his reign. Which was closely followed by the still more ample concessions made by that unhappy prince to his parliament, before the fatal rupture between them; and by the many salutary laws, particularly the *habeas corpus* act, passed under Charles II. To these succeeded the *bill of rights*, or declaration delivered by the lords and commons to the prince and princeps of Orange, 13th February 1688; and afterwards enacted in parliament, when they became king and queen: which declaration concludes in these remarkable words; "and they do claim, demand, and insist upon, all and singular the premises, as their undoubted rights and liberties." And the act of parliament itself recognises "all and singular the rights and liberties asserted and claimed in the said declaration to be the true, ancient, and indubitable rights of the people of this kingdom." Lastly, these liberties were again asserted at the commencement of the present century, in the *act of settlement*, whereby the crown was limited to his present majesty's illustrious house: and some new provisions were added, at the same fortunate era, for better securing our religion, laws, and liberties; which the statute declares to be "the birthright of the people of England," according to the ancient doctrine of the common law.

Thus much for the *declaration* of our rights and liberties. The rights themselves, thus defined by these several statutes, consist in a number of private immunities; which will appear, from what has been premised, to be indeed no other, than either that *residuum* of natural liberty, which is not required by the laws of society to be sacrificed to public convenience; or else those civil privileges, which society hath engaged to provide, in lieu of the natural liberties so given up by individuals. These therefore were formerly, either by inheritance or purchase, the rights of all mankind; but, in most other countries of the world, being now more or less debased and destroyed, they at present may be said to remain, in a peculiar and emphatical manner, the rights of the people of Britain. And these may be reduced to three principal or primary articles; the right of personal security, the right of personal liberty, and the right of private property: because, as there is no other known method of compulsion, or of abridging man's natural free-will, but by an infringement or diminution of one or other of these important rights, the preservation of these inviolate may justly be said to include the preservation of our civil immunities in their largest and most extensive sense. See the article *RIGHTS*.

In vain, however, would these rights be declared, ascertained, and protected by the dead letter of the laws, if the constitution had provided no other method to secure their actual enjoyment. It has therefore established certain other auxiliary subordinate rights of the subject, which serve principally as barriers to protect and maintain inviolate the three great and pri-

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Liberty.

mary rights, of personal security, personal liberty, and private property. These are,

1. The constitution, powers, and privileges of parliament; for which see PARLIAMENT.

2. The limitation of the king's prerogative, by bounds to certain and notorious; that it is impossible he should exceed them without the consent of the people; as to which, see PREROGATIVE. The former of these keeps the legislative power in due health and vigour, so as to make it improbable that laws should be enacted destructive of general liberty: the latter is a guard upon the executive power, by restraining it from acting either beyond or in contradiction to the laws that are framed and established by the other.

3. A third subordinate right of every Briton is that of applying to the courts of justice for redress of injuries. Since the law is, in this realm, the supreme arbiter of every man's life, liberty, and property, courts of justice must at all times be open to the subject, and the law be duly administered therein. The emphatical words of *magna carta*, spoken in the person of the king, who in judgment of law (says Sir Edward Coke) is ever present and repeating them in all his courts, are these: *Nulli vendemus, nulli negabimus, aut differemus rectum vel iustitiam*; "and therefore every subject (continues the same learned author), for injury done to him in *bonis, in terris, vel persona*, by any other subject, be he ecclesiastical or temporal, without any exception, may take his remedy by the course of the law, and have justice and right for the injury done to him, freely without fee, fully without any denial, and speedily without delay." It were endless to enumerate all the *affirmative* acts of parliament, wherein justice is directed to be done according to the law of the land: and what that law is, every subject knows; or may know if he pleases: for it depends not upon the arbitrary will of any judge; but is permanent, fixed, and unchangeable, unless by authority of parliament. We shall however just mention a few *negative* statutes, whereby abuses, perversions, or delays of justice, especially by the prerogative, are restrained. It is ordained by *magna carta*, that no freeman shall be outlawed, that is, put out of the protection and benefit of the laws, but according to the law of the land. By 2 Edw. III. c. 8. and 11 Ric. II. c. 10. it is enacted, that no commands or letters shall be sent under the great seal, or the little seal, the signet or privy seal, in disturbance of the law; or to disturb or delay common right: and, though such commandments should come, the judges shall not cease to do right: which is also made a part of their oath by statute 18 Edw. III. §. 4. And by 1 W. & M. §. 2. c. 2. it is declared, that the pretended power of suspending or dispensing with laws, or the execution of laws, by regal authority without consent of parliament, is illegal.

Not only the substantial part, or judicial decisions, of the law, but also the formal part, or method of proceeding, cannot be altered but by parliament: for, if once those outworks were demolished, there would be an inlet to all manner of innovation in the body of the law itself. The king, it is true, may erect new courts of justice; but then they must proceed according to the old established forms of the common law. For which reason it is declared in the statute 16 Car. I.

Liberty.

c. 10. upon the dissolution of the court of star-chamber, that neither his majesty, nor his privy-council, have any jurisdiction, power, or authority, by English bill, petition, articles, libel (which were the course of proceeding in the star-chamber, borrowed from the civil law), or by any other arbitrary way whatsoever, to examine, or draw into question, determine, or dispose of the lands or goods of any subjects of this kingdom; but that the same ought to be tried and determined in the ordinary courts of justice, and by *course of law*.

4. If there should happen any uncommon injury, or infringement of the rights before mentioned, which the ordinary course of law is too defective to reach, there still remains a fourth subordinate right, appertaining to every individual, namely, the right of petitioning the king, or either house of parliament, for the redress of grievances. In Russia we are told, that the Czar Peter established a law, that no subject might petition the throne till he had first petitioned two different ministers of state. In case he obtained justice from neither, he might then present a third petition to the prince; but upon pain of death, if found to be in the wrong. The consequence of which was, that no one dared to offer such third petition; and grievances seldom falling under the notice of the sovereign, he had little opportunity to redress them. The restrictions, for some there are, which are laid upon petitioning in Britain, are of a nature extremely different; and while they promote the spirit of peace, they are no check upon that of liberty. Care only must be taken, lest, under the pretence of petitioning, the subject be guilty of any riot or tumult; as happened in the opening of the memorable parliament in 1640: and, to prevent this, it is provided by the statute 13 Car. II. §. 1. c. 5. that no petition to the king, or either house of parliament, for any alteration in church or state, shall be signed by above 20 persons, unless the matter thereof be approved by three justices of the peace, or the major part of the grand jury, in the country; and in London, by the lord mayor, aldermen, and common-council: nor shall any petition be presented by more than 10 persons at a time. But, under these regulations, it is declared by the statute 1 W. & M. §. 2. c. 2. that the subject hath a right to petition; and that all commitments and prosecutions for such petitioning are illegal.

5. The fifth and last auxiliary right of the subject, that we shall at present mention, is that of having arms for their defence, suitable to their condition and degree, and such as are allowed by law. Which is also declared by the same statute 1 W. & M. §. 2. c. 2. and is indeed a public allowance, under due restrictions, of the natural right of resistance and self-preservation, when the sanctions of society and laws are found insufficient to restrain the violence of oppression.

In these several articles consist the rights, or, as they are frequently termed, the *liberties of Britons*: liberties more generally talked of, than thoroughly understood; and yet highly necessary to be perfectly known and considered by every man of rank or property, lest his ignorance of the points whereon they are founded should hurry him into faction and licentiousness on the one hand, or a pusillanimous indiffe-

Liberty.

rence and criminal submission on the other. And we have seen that these rights consist, primarily, in the free enjoyment of personal security, of personal liberty, and of private property. So long as these remain inviolate, the subject is perfectly free; for every species of compulsive tyranny and oppression must act in opposition to one or other of these rights, having no other object upon which it can possibly be employed. To preserve these from violation, it is necessary that the constitution of parliaments be supported in its full vigour; and limits, certainly known, be set to the royal prerogative. And, lastly, to vindicate these rights, when actually violated or attacked, the subjects of Britain are intitled, in the first place, to the regular administration and free course of justice in the courts of law; next, to the right of petitioning the king and parliament for redress of grievances; and, lastly, to the right of having and using arms for self preservation and defence. And all these rights and liberties it is our birthright to enjoy entire; unless where the laws of our country have laid them under necessary restraints. Restraints in themselves so gentle and moderate, as will appear upon farther inquiry, that no man of sense or probity would wish to see them slackened. For all of us have it in our choice to do every thing that a good man would desire to do; and are restrained from nothing, but what would be pernicious either to ourselves or our fellow-citizens. So that this review of our situation may fully justify the observation of a learned French author, who indeed generally both thought and wrote in the spirit of genuine freedom; and who hath not scrupled to profess, even in the very bosom of his native country, that the British is the only nation in the world, where political or civil liberty is the direct end of its constitution. Recommending therefore to the student in our laws a farther and more accurate search into this extensive and important title, we shall close our remarks upon it with the expiring wish of the famous Father Paul to his country, "ESTO PERPETUA!"

LIBERTY and Necessity. See METAPHYSICS.

LIBERTY of the Press. The art of printing, soon after its introduction, was looked upon in England, as well as in other countries, as merely a matter of state, and subject to the coercion of the crown. It was therefore regulated with us by the king's proclamations, prohibitions, charters of privilege and licence, and finally by the decrees of the court of star-chamber, which limited the number of printers, and of presses which each should employ, and prohibited new publications unless previously approved by proper licensers. On the demolition of this odious jurisdiction in 1641, the long parliament of Charles I. after their rupture with that prince, assumed the same powers as the star-chamber had exercised with respect to the licensing of books: and in 1643, 1647, 1649, and 1652 (Scobell. i. 44, 134. ii. 88, 230.) issued their ordinances for that purpose, founded principally on the star-chamber decree of 1637. In 1662, was passed the statute 13 & 14. Car. II. c. 33. which, with some few alterations, was copied from the parliamentary ordinances. This act expired in 1679; but was revived by statute 1 Jac. II. c. 17. and continued till 1692. It was then continued for two years longer by statute 4 W. & M. c. 24. but though frequent attempts were made by the govern-

Nº 181.

ment to revive it, in the subsequent part of that reign (Com. Journ. 11 Feb. 1694. 26 Nov. 1695. 22 Oct. 1696. 9 Feb. 1697. 31 Jan. 1698.) yet the parliament resisted it so strongly, that it finally expired, and the press became properly free in 1694, and has continued so ever since.

The liberty of the press, however, so essential to the nature of a free state, consists not in freedom from censure for any criminal matter that may be published, but in laying no previous restraints upon publications. Every freeman has undoubtedly a right to lay what sentiments he pleases before the public; to forbid this, is to destroy the freedom of the press: but if he publishes what is improper, mischievous, or illegal, he must take the consequence of his own temerity †. To subject the press to the restrictive power of a licenser in the manner above mentioned, is to subject all freedom of sentiment to the prejudices of one man, and make him the arbitrary and infallible judge of all controverted points in learning, religion, and government. But to punish (as the law does at present) any dangerous or offensive writings which, when published, shall, on a fair and impartial trial, be adjudged of a pernicious tendency, is necessary for the preservation of peace and good order, of government and religion, the only solid foundations of civil liberty. Thus the will of individuals is still left free; the abuse only of that free-will is the object of legal punishment. Neither is any restraint hereby laid upon freedom of thought or inquiry; liberty of private sentiment is still left; the disseminating or making public of bad sentiments, destructive of the ends of society, is the crime which society corrects. A man (says a fine writer on this subject) may be allowed to keep poisons in his closet, but not publicly to vend them as cordials. And to this we may add, that the only plausible argument heretofore used for restraining the just freedom of the press, "that it was necessary to prevent the daily abuse of it," will entirely lose its force, when it is shown (by a seasonable exertion of the laws) that the press cannot be abused to any bad purpose without incurring a suitable punishment: whereas, it can never be used to any good one when under the controul of an inspector. So true will it be found, that to censure the licentiousness, is to maintain the liberty of the press.

LIBERTY, in mythology, was a goddess both among the Greeks and Romans. Among the former she was invoked under the title *Eleutheria*; and by the latter she was called *Libertas*, and held in singular veneration; temples, altars, and statues, were erected in honour of this deity. A very magnificent temple was consecrated to her on mount Aventin, by Tiberius Gracchus, before which was a spacious court, called *atrium libertatis*. The Romans also erected a new temple in honour of Liberty, when Julius Cæsar established his empire over them, as if their liberty had been secured by an event which proved fatal to it. In a medal of Brutus, Liberty is exhibited under the figure of a woman, holding in one hand a cap, the symbol of Liberty, and two poinards in the other, with the inscription *LIBERTAS MARTIS*.

LIBETHRA (anc. geog.), the fountain of song, was situated in Magnesia, a district of Macedonia annexed to Thessaly; distinct from the town of Libethra, which stood on the mount Olympus, where it

Liberty.
Libethra.

† See Liberty.

Librius verges towards Macedonia: hence the Muses are called *Libethrides*, (Virgil.) Strabo places on Helicon, not only Hippocrene, and the temple of the Muses, but also the cave of the nymphs Libethrides.

LIBETHRIUS MONS (anc. geog.), a mountain of Boeotia, distant from Coronea 40 stadia; where stood the statues of the Muses, and of the nymphs, surnamed *Libethride*. A mountain probably conjoined with, or at least very near to, Helicon.

LIBITINA, in the Roman mythology, a goddess which presided over funerals. This goddess was the same with the *Venus infera* or *Epithymia* of the Greeks. She had a temple at Rome, where was lodged a certain piece of money for every person who died, whose name was recorded in a register called *Libitina ratio*. This practice was established by Servius Tullius, in order to obtain an account of the number of annual deaths in the city of Rome, and consequently the rate of increase or decrease of its inhabitants.

LIBITINARIUM, were undertakers whose office it was to take care of funerals, prepare all things necessary upon the solemn occasion, and furnish every article required.—They got their livelihood by this gloomy business, and kept a number of servants to perform the working part of the profession, such as the *pollinctores*, *vespillones*, &c. The name *Libitinarium* is derived from *Libitina*, the goddess of funerals, in whose temple were sold all things relating to funerals. See **FUNERAL**.

LIBNA (anc. geog.), a sacerdotal city in the tribe of Judah, a place of strength, as appears from Sennacherib's laying siege to it, 2 Kings xix. Isaiah xxxvii. In Jerome's time, a village, called *Lobna*, in the territory of Eleutheropolis.

LIBOURNE, a town of France, in Guienne, and in Bourdelois. It is a populous trading town, and is seated on the river Dordogne. W. Long. o. 10. N. Lat. 44. 55.

LIBRA, or **BALANCE**, one of the mechanical powers. See **BALANCE**.

LIBRA, in astronomy, one of the 12 signs of the zodiac, and exactly opposite to Aries; so called because when the sun is in this sign at the autumnal equinox, the days and nights are equal as if weighed in a balance.—The stars in this constellation according to Ptolemy are 17, Tycho 10, Hevelius 20, and Flamsteed 51.

LIBRA also denotes the ancient Roman pound, borrowed from the Sicilians, who called it *libra*.

The libra was divided into 12 *uncie* or ounces, and the ounce into 24 scruples.

The divisions of the libra were, the *uncia*, one twelfth; the *sextans*, one sixth; the *quadrans*, one fourth; the *triens*, one third; the *quincunx*, five ounces; the *semis*, six; the *septunx*, seven; the *bes*, eight; the *dodrans*, nine; the *dextrans*, ten; the *denus*, eleven; lastly, the *as* weighed twelve ounces or one libra.

The Roman libra was used in France for the proportions of their coin till the time of Charlemagne, or perhaps till that of Philip I. in 1093, their sols being so proportioned, as that 20 of them were equal to the libra. By degrees it became a term of account; and every thing of the value of twenty sols was called a *livre*.

Vol. X. Part I.

LIBRA pēsa, in our law books, denotes a pound of money in weight. It was usual in former days not only to tell the money but to weigh it: because many cities, lords, and bishops, having their mints, coined money, and often very bad too; for which reason, though the pound consisted of 20 shillings, they always weighed it.

LIBRARIUM, among the ancients, were a sort of copyists who transcribed in beautiful or at least legible characters, what had been written by the notarii in notes and abbreviations.

LIBRARY, an edifice or apartment destined for holding a considerable number of books placed regularly on shelves; or the books themselves lodged in it.

Some authors refer the origin of libraries to the Hebrews; and observe, that the care these took for the preservation of their sacred books, and the memory of what concerned the actions of their ancestors, became an example to other nations, particularly to the Egyptians. Osmanduas, king of Egypt, is said to have taken the hint first; who, according to Diodorus, had a library built in his palace, with this inscription over the door, *ἡ τῆς βασιλείας βιβλιοθήκη*. Nor were the Ptolemies, who reigned in the same country, less curious and magnificent in books.

The scripture also speaks of a library of the kings of Persia, Ezra v. 17. vi. 1. which some imagine to have consisted of the historians of that nation, and of memoirs of the affairs of state; but, in effect, it appears rather to have been a depository of laws, charters, and ordinances of the kings. The Hebrew text calls it the *house of treasures*, and afterwards the *house of the rolls*, where the treasures were laid up. We may, with more justice, call that a *library*, mentioned in the second of Esdras to have been built by Nehemiah, and in which were preserved the books of the prophets, and of David, and the letters of their kings.

The first who erected a library at Athens, was the tyrant Pisistratus; and yet Strabo refers the honour of it to Aristotle. That of Pisistratus was transported by Xerxes into Persia, and was afterwards brought back by Seleucus Nicanor to Athens. Long after, it was plundered by Sylla, and re-established by Hadrian. Plutarch says, that under Eumenes there was a library at Pergamus, containing 200,000 books. Tyrannian, a celebrated grammarian, contemporary with Pompey, had a library of 30,000 volumes. That of Ptolemy Philadelphus, according to A. Gellius, contained 700,000, all in rolls, burnt by Caesar's soldiers.

Constantine, and his successors, erected a magnificent one at Constantinople; which in the eighth century contained 300,000 volumes, all burnt by order of Leo Isaurus; and, among the rest, one wherein the Iliad and Odyssey were written in letters of gold, on the guts of a serpent.

The most celebrated libraries of ancient Rome, were the Ulpian, and the Palatine. They also boast much of the libraries of Paulus Æmilius, who conquered Perseus; of Lucilius Lucullus, of Asinius Pollio, Atticus, Julius Severus, Domitius, Serenus, Pamphilus Martyr, and the emperors Gordian and Trajan.

Anciently, every large church had its library; as appears by the writings of St Jerome, Anastasius, and others. Pope Nicholas laid the first foundation of

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that

Libra
Library.

that of the Vatican, in 1450. It was destroyed by the conftable Bourbon, in the facking of Rome, and reftored by Pope Sixtus V. and has been confiderably enriched with the ruins of that of Heidelberg, plundered by Count Tilly in 1622. One of the moft complete libraries in Europe, was faid to be that erected at Florence by Cofmo de Medicis, over the gate whereof is written, *LABOR ABSQUE LABORE*; though it is now exceeded by that of the French king, begun by Francis I. augmented by Cardinal Richelieu, and completed by M. Colbert.

The emperor's library at Vienna, according to Lambecius, confifts of 80,000 volumes, and 15,940 curious medals.

The Bodleian library at Oxford, built on the foundation of that of Duke Humphry, exceeds that of any univerfity in Europe, and even thofe of all the fovereigns of Europe, except the emperor's and French king's, which are each of them older by 100 years. It was firft opened in 1602, and has fince found a great number of benefactors; particularly Sir Robert Cotton, Sir H. Savil, Archbifhop Laud, Sir Kenelm Digby, Mr Allen, Dr Pococke, Mr Selden, and others. The Vatican, the Medicean, that of Beflarion at Venice, and thofe juft mentioned, exceed the Bodleian in Greek manucripts: which yet outdoes them all in Oriental manucripts.

As to printed books, the Ambrofian at Milan, and that of Wolfenbuttle, are two of the moft famous, and yet both inferior to the Bodleian.

King's LIBRARY, at St James's, was founded by Henry, eldeft fon of James I. and made up partly of books, and partly of manucripts, with many other curiofities, for the advancement of learning. It has received many additions from the libraries of Ifaac Cafaubon and others.

Coltonian LIBRARY, originally confifted of 958 volumes of original charters, grants, inftruments, letters of fovereign princes, tranfactions between this and other kingdoms and ftates, genealogies, hiftories, registers of monafteries, remains of Saxon laws, the book of Genefis, thought to be the moft ancient Greek copy extant, and faid to have been written by Origen in the fecond century, and the curious Alexandrian copy or manucript in Greek capitals. This library is kept in the Britifh Mufeum, with the large and valuable library of Sir Hans Sloane, amounting to upwards of 42,000 volumes, &c. There are many public libraries belonging to the feveral colleges at Oxford and Cambridge, and the univerfities in North Britain. The principal public libraries in London, befide that of the Mufeum, are thofe of the college of heralds, of the college of phyficians, of Doctors Commons, to which every bifhop, at the time of his confecration, gives at leaft 20l. fometimes 50l. for the purchafe of books; thofe of the Gray's Inn, Lincoln's Inn, Inner Temple, and Middle Temple; that of Lambeth, founded by Archbifhop Bancroft in 1610, for the ufe of fucceeding archbifhops of Canterbury, and increafed by the benefactions of Archbifhops Abbot, Sheldon, and Tennifon, and faid to confift of at leaft 15,000 printed books, and 617 volumes in manucript; that of Red-Crofs ftreet, founded by Dr Daniel Williams, a Prefbyterian divine, and fince enriched by many private benefactions; that of the Royal

Society, called the *Arundelion* or *Norfolk library*, becaufe the principal part of the collection formerly belonged to the family of Arundel, and was given to the fociety by Henry Howard, afterwards duke of Norfolk, in 1666, which library has been increafed by the valuable collection of Francis Alton, Efq; in 1715, and is continually increafing by the numerous benefactions of the works of its learned members, and others: that of St Paul's, of Sion college; the queen's library, erected by Queen Caroline in 1737; and the furgeon's library, kept in their hall in the Old Bailey, &c.

In Edinburgh there is a good library belonging to the univerfity, well furnifhed with books; which are kept in good order. There is alfo a noble library of books and manucripts belonging to the faculty of advocates. See *ADVOCATE*.

LIBRATION, in aftronomy, an apparent irregularity of the moon's motion, whereby fhe feems to librate about her axis, fometimes from the eaft to the weft, and now and then from the weft to the eaft. See *ASTRONOMY*, n° 420.

LIBURNIA (anc. geog.), a diftrict of Illyricum, extending towards the Adriatic between Iftria on the weft, Dalmatia on the eaft, and mount Albus on the north. *Liburni*, the people. The apparitors, who at the command of the magiftrate fummoned the people from the country, were called *Liburni*, becaufe generally men of *Liburnia*.—*Liburna*, or *Lilurnica*, (Horace), denoted a kind of light and fwift fkiif, ufed by the Liburnians in their fea-rovings or piracies, for which they were noted. *Liburnum* (Juvenal), was a fpecies of litter made in form of Liburnian fkiiffs, wherein the noblemen of Rome were carried, and where they fat at their eaft, either reading or writing.

LIBURNUS (anc. geog.), a mountain of Campania. Alfo a port of Tufcany. Now *Livorno*, or *Leghorn*. E. Long. 11. N. Lat. 43. 30.

LIBYA, in general, according to the Greeks, denoted Africa. An appellation derived from *hub*, "thirft," being a dry and thirfty country. See *AFRICA*.

LIBYA, in a more reftained fenfe, was the middle part of Africa, extending north and weft, (Pliny); between the Mediterranean to the north, and Ethiopia to the eaft; and was two-fold, the *Hiiber* or *Exterior Libya*; and the *Farther* or *Interior*. The former lay between the Mediterranean on the north, and the *Farther Libya* and Ethiopia beyond Egypt on the fouth, (Ptolemy). The *Farther* or *Interior Libya*, was a vaft country, lying between the *Hiiber Libya* on the north, the Atlantic ocean on the weft, the Ethiopic on the fouth, and Ethiopia beyond Egypt on the eaft, (Ptolemy).

LIBYA, in a ftill more reftained fenfe, called, for diftinction's fake, *Libya Propria*, was a northern diftrict of Africa, and a part of the *Hiiber Libya*; fited between Egypt to the eaft, the Mediterranean to the north, the Syrtis Major and the Regio Tripolitana to the weft, the Garamantes and Ethiopia beyond Egypt to the fouth. Now the kingdom and defart of *Barca*. This Libya was again fubdivided into *Libya* taken in the ftrictelt fenfe of all, and into Marmarica and Cyrenaica. *Libya* in the ftrictelt fenfe, otherwife the *Exterior*, was the moft eaftern part of *Libya Propria*, next to Egypt, with Marmarica on the weft, the

Licence
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Lichen.

Mediterranean on the north, and the Nubi, now called *Nubia*, to the south, (Ptolemy).

LICENCE, in law, an authority given to a person to do some lawful act.

LICENSER of the *Press*. See *LIBERTY of the Press*.

LICENTIATE, one who has obtained the degree of a licence.—The greatest number of the officers of justice in Spain are distinguished by no other title than that of *licentiate*. In order to pass *licentiate* in common law, civil law, and physic, they must have studied seven years, and in divinity ten. Among us a *licentiate* usually means a physician who has a licence to practise, granted by the college of physicians.

LICETUS, a celebrated physician of Italy, was born at Rappollo, in the state of Genoa, 1577. He came, it seems, into the world, before his mother had completed the seventh month of her pregnancy; but his father, being an ingenious physician, wrapped him up in cotton, and nurtured him so, that he lived to be 77 years of age. He was trained with great care, and became a very distinguished man in his profession; and was the author of a great number of works: his book *De Morbis* every body must have heard of. He was professor of philosophy and physic at Padua, where he died in 1655.

LICHEN, LIVER WORT, in botany; a genus of the natural order of algae, belonging to the cryptogamia class of plants. The male receptacle is roundish, somewhat plain and shining. In the female the leaves have a farina or mealy substance scattered over them. There are about 130 species, all found in Britain. Among the most remarkable are the following:

1. The *geographicus*; it is frequent in rocks, and may be readily distinguished at a distance. The crust or ground is of a bright greenish-yellow colour, sprinkled with numerous plain black tubercles; which frequently run into one another, and form lines resembling the rivers in a map, from which last circumstance it takes its name.

2. The *calcareus*, or black-nobbed dyer's lichen, is frequent on calcareous rocks; and hath a hard, smooth, white, stoney, or tartareous crust, cracked or tessellated on the surface, with black tubercles. Dillenius relates, that this species is used in dyeing, in the same manner as the *tartareus* after mentioned.

3. The *ventosus*, or red spangled tartareous lichen, hath a hard tartareous crust, cracked and tessellated on the surface, of a pale yellow colour when fresh, and a light olive when dry. The tubercles are of a blood-red colour at top, their margin and base of the same colour as the crust. The texture and appearance of this (according to Mr Lightfoot), indicate that it would answer the purposes of dyeing as well as some others of this tribe, if proper experiments were made.

4. The *candelarius*, or yellow farinaceous lichen, is common upon walls, rocks, boards, and old pales. There are two varieties. The first has a farinaceous crust of no regular figure, covered with numerous, small, greenish-yellow, or olive shields, and grows commonly upon old boards. The other has a smooth, hard, circular crust, wrinkled and lobed at the circumference, which adheres closely to rocks and stones. In the centre are numerous shields of a deeper yellow or orange colour, which, as they grow old, swell in the middle, and assume the figure of tubercles. The inhabitants of Smaland in Sweden scrape this lichen from

the rocks, and mix it with their tallow, to make golden candles to burn on festival days.

5. The *tartarius*, or large yellow-faucer'd dyer's lichen, is frequent on rocks, both in the Highlands and Lowlands of Scotland. The crust is thick and tough, either white, or greenish-white, and has a rough warted surface. The shields are yellow or buff-coloured, of various sizes, from that of a pin's head to the diameter of a silver penny. Their margins are of the same colour as the crust. This lichen is much used by the Highlanders for dyeing a fine claret or pompadour colour. For this purpose, after scraping it from the rocks, and cleaning it, they steep it in urine for a quarter of a year. Then taking it out, they make it into cakes, and hang them up in bags to dry. These cakes are afterwards pulverised, and the powder is used to impart the colour with an addition of alum.

6. The *parellus*, or crawfish-eye lichen, grows upon walls and rocks, but is not very common. The crusts spread closely upon the place where they grow, and cover them to a considerable extent. They are rough, tartareous, and ash-coloured, of a tough coriaceous substance. The shields are numerous and crowded, having white or ash-coloured, shallow, plain discs, with obtuse margins. This is used by the French for dyeing a red colour.

7. The *saxatilis*, or grey-blue pitted lichen, is very common upon trunks of trees, rocks, tiles, and old wood. It forms a circle two or three inches diameter. The upper surface is of a blue-grey and sometimes of a whitish ash-colour, uneven, and full of numerous small pits or cavities; the under side is black, and covered all over, even to the edges, with short simple hairs or radicles. A variety sometimes occurs with leaves tinged of a red or purple colour. This is used by finches and other small birds in constructing the outside of their curiously formed nests.

8. The *omphalodes*, or dark-coloured dyers lichen, is frequent upon rocks. It forms a thick widely-expanded crust of no regular figure, composed of numerous imbricated leaves of a brown or dark-purple colour, divided into small segments. The margins of the shields are a little crisped and turned inwards, and their outside ash-coloured. The lichen is much used by the Highlanders in dyeing a reddish brown colour. They steep it in urine for a considerable time, till it becomes soft and like a paste; then, forming the paste into cakes, they dry them in the sun, and preserve them for use in the manner already related of the *tartarius*.

9. The *parietinus*, or common yellow wall-lichen, is very common upon walls, rocks, tiles of houses, and trunks of trees. It generally spreads itself in circles of two or three inches diameter, and is said to dye a good yellow or orange colour with alum.

10. The *islandicus*, or eatable Iceland lichen, grows on many mountains both of the Highlands and Lowlands of Scotland. It consists of nearly erect leaves about two inches high, of a stiff substance when dry, but soft and pliant when moist, variously divided without order into broad distant segments, bifid or trifid at the extremities. The upper or interior surface of the leaves is concave, chequered colour, smooth, and shining, but red at the base; the under or exterior surface is smooth and whitish, a little pitted, and sprinkled with very minute black warts. The margins of the leaves and all the segments from bottom to top are ciliated with small,

Lichen.

short, stiff, hair-like spinules, of a dark chestnut colour, turning towards the upper side. The shields are very rarely produced. For the uses of this as an esculent herb, see ICELAND, n° 10. Made into broth or gruel, it is said to be very serviceable in coughs and consumptions; and, according to Haller and Scopoli, is much used in these complaints in Vienna.

11. The pulmonarius, or lung-wort lichen, grows in shady woods upon the trunks of old trees. The leaves are as broad as a man's hand, of a kind of leather-like substance, hanging loose from the trunk on which it grows, and laciniated into wide angular segments. Their natural colour, when fresh, is green; but in drying, they turn first to a glaucous and afterwards to a fuscous colour. It has an astringent, bitter taste; and, according to Gmelin, is boiled in ale in Siberia, instead of hops. The ancients used it in coughs and asthma, &c. but it is not used in modern practice.

12. The calicaris, or beaked lichen, grows sometimes upon trees, but more frequently upon rocks, especially on the sea-coasts, but is not very common. It is smooth, glossy, and whitish, producing flat or convex shields, of the same colour as the leaves, very near the summits of the segments, which are acute and rigid, and, being often reflected from the perpendicular by the growth of the shields, appear from under their limbs like a hooked beak. This will dye a red colour; and promises, in that intention, to rival the famous *Lichen Rocella* or *Argol*, which is brought from the Canary Islands, and sometimes sold at the price of 80 l. per ton. It was formerly used instead of starch to make hair-powder.

13. The prunastri, or common ragged hoary lichen, grows upon all sorts of trees; but it is generally moist white and hoary on the sloe and old palm trees, or upon old pines. This is the most variable of the whole tribe of lichens, appearing different in figure, magnitude, and colour, according to its age, place of growth, and sex. The young plants are of a glaucous colour, slightly divided into small acute crested segments. As they grow older, they are divided like a stag's horn, into more and deeper segments, somewhat broad, flat, soft, and pitted on both sides, the upper surface of a glaucous colour, the under one white and hoary.—The male plants, as Linnæus terms them, are short, seldom more than an inch high, not hoary on the under side; and have pale glaucous shields situated at the extremities of the segments, standing on short peduncles, which are only small stiff portions of the leaf produced.—The female specimens have numerous farinaceous tubercles both on the edges of their leaves, and the wrinkles of their surface.—The pulverised leaves have been used as a powder for the hair, and also in dyeing yarn of a red colour.

14. The juniperinus, or common yellow tree-lichen, is common upon the trunks and branches of elms and many other trees. Linnæus says it is very common upon the juniper. The Gothland Swedes dye their yarn of a yellow colour with it, and give it as a specific in the jaundice.

15. The caninus, or ash-coloured ground-liverwort, grows upon the ground among moss, at the roots of trees in shady woods, and is frequent also in heaths and stony places. The leaves are large, gradually dilated towards the extremities, and divided into roundish elevated lobes. Their upper side, in dry weather, is ash-

coloured; in rainy weather, of a dull fuscous green colour; their under-side white and hoary, having many thick downy nerves, from which descend numerous, long, white, pencil-like radicles. The peltæ, or shields, grow at the extremities of the elevated lobes, shaped like the human nail; of a roundish oval form, convex above, and concave beneath; of a chocolate colour on the upper side, and the same colour with the leaves on the under. There are two varieties, the one called *reddish*, and the other *many-fingered*, ground-liverwort. The former is more common than the other. This species has been rendered famous by the celebrated Dr Mead, who asserted that it was an infallible preventative of the dreadful consequences attending the bite of a mad dog. He directed half an ounce of the leaves dried, and pulverised to be mixed with two drachms of powdered black pepper. This was to be divided into four doses, one of which was to be taken by the patient every morning fasting, for four mornings successively, in half a pint of warm cow's milk; after which he was to use the cold bath every morning for a month. It is much to be lamented, however, that the success of this medicine, or indeed any other recommended for the same purpose, hath not always answered the expectation. There are instances where the application has not prevented the hydrophobia, and it is even uncertain whether it has ever been instrumental in keeping off that disorder.

16. The apothosus, or green ground-liverwort with black warts, grows upon the ground at the roots of trees in woods, and other stony and mossy places. It differs very little from the foregoing, and according to some is only a variety of it. Linnæus informs us, that the country-people of Upland in Sweden give an infusion of this lichen in milk to children that are troubled with the disorder called the *thrush* or *apthæ*, which induced that ingenious naturalist to bestow upon it the trivial name of *apthosus*. The same writer also tells us, that a decoction of it in water purges upwards and downwards, and will destroy worms.

17. The cocciferus, or scarlet-tipped cup-lichen, is frequent in moors and heaths. It has in the first state a granulated crust for its ground, which is afterwards turned into small laciniated leaves, green above, and hoary underneath. The plant assumes a very different aspect, according to the age, situation, and other accidents of its growth; but may be in general readily distinguished by its frutifications, which are fungous tubercles of a fine scarlet colour, placed on the rim of the cup, or on the top of the stalk. These tubercles, steeped in an alkaline lixivium, are said to dye a fine durable red colour.

18. The rangiferinus, or rein-deer lichen, is frequent in woods, heaths, and mountainous places. Its general height, when full grown, is about two inches. The stalk is hollow, and very much branched from bottom to top: the branches are divided and subdivided, and at last terminated by two, three, four, or five very fine, short, nodding horns. The axillæ of the branches are often perforated. The whole plant is of a hoary white or grey colour, covered with white farinaceous particles, light and brittle when dry, soft and elastic when moist. The frutifications are very minute, round, fuscous, or reddish-brown tubercles, which grow on the very extremities of the finest branches; but these

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tubercles are very seldom found. The plant seems to have no foliaceous ground for the base, nor scarcely any visible roots.—Linneus tells us, that in Lapland this moss grows so luxuriant that it is sometimes found a foot high. There are many varieties of this species, of which the principal is the *sylvaticus*, or brown-tipt rein-deer lichen. The most remarkable difference between them is, that the *sylvaticus* turns fulvous by age, while the other always continues white. For the uses of these species, see LAPLAND.

19. The *plicatus*, or official stringy lichen, grows on the branches of old trees, but is not very common. The stalks are a foot or more in length, cylindrical, rigid, and, string-shaped, very irregularly branched, the branches entangled together, of a cinereous or ash-colour, brittle and stringy if doubled short, otherwise tough and pliant, and hang pendent from the trees on which they grow. The shields grow generally at the extremities of the branches, are nearly flat, or slightly concave, thin, ash-coloured above, pale-brown underneath, and radiated with fine rigid fibres. As the plant grows old, the branches become covered with a white, rough, warty crust; but the young ones are destitute of it. It was formerly used in the shops as an astringent to stop hæmorrhages, and to cure ruptures; but is out of the modern practice. Linneus informs us, that the Laplanders apply it to their feet to relieve the excoriations occasioned by much walking.

20. The *barbatus*, or bearded lichen, grows upon the branches of old trees in thick woods and pine-forests. The stalks or strings are slightly branched and pendulous, from half a foot to two feet in length, little bigger than a tailor's common sewing thread; cylindrically jointed towards the base; but surrounded every where else with numerous, horizontal, capillary fibres, either simple or slightly branched. Their colour is a whitish green. This has an astringent quality like the preceding. When steeped in water, it acquires an orange colour; and, according to Dillenius, is used in Pennsylvania for dyeing that colour.

21. The *vulpinus*, or gold-wiry lichen, grows upon the trunks of old trees, but is not very common. It is produced in erect tufts, from half an inch to two inches in height, of a fine yellow or lemon-colour, which readily discovers it. The filaments which compose it are not cylindrical, but a little compressed and uneven in the surface, variously branched, the angles obtuse, and the branches straggling and entangled one with another. Linneus informs us, that the inhabitants of Smaland in Sweden dye their yarn of a yellow colour with this lichen; and that the Norwegians destroy wolves by stuffing dead carcases with this moss reduced to powder, and mixed with pounded glass, and so exposing them in the winter-season to be devoured by those animals.

LICHFIELD. See LITCHFIELD.

LICHTENBERG, a castle of France, in Lower Alsace, and the chief place of a county of the same name; seated on a rock, near the mountains Volges, and is looked upon as impregnable. E. Long. 7. 35. N. Lat. 48. 55.

LICHTENBURG, a town of Germany, in the circle of Franconia, and margravate of Culmbach. E. Long. 12. 0. N. Lat. 50. 26.

LICHTENFELS, a town of Germany, in the

circle of Franconia, and bishopric of Bamberg, seated on the river Mayne, in E. Long. 11. 10. N. Lat. 50. 20.

LICHTENSTEIN, a town of Switzerland, in Tockenberg, seated on the river Thour. E. Long. 2. 15. N. Lat. 47. 25.

LICHTSTALL, an handsome town of Switzerland, in the county of Basle; seated on the river Ergetz. In E. Long. 7. 57. N. Lat. 47. 40.

LICINIUS STOLO, a famous Roman tribune, styled *Stolo* on account of a law he made, while tribune, that no Roman citizen should possess more than 500 acres of land; alleging, that when they occupied more, they could not cultivate it with care, nor pull up the useless shoots (*folones*) that grow from the roots of trees. He is memorable also for enacting, that one of the consuls should always be of a Plebeian family. He lived about 362 B. C.

LICNON, in the Dionysian solemnities, the mystical van of Bacchus; a thing so essential to all the solemnities of this god, that they could not be duly celebrated without it. See DIONYSIA.

LICNOPHORI, in the Dionysian solemnity, those who carried the licnon.

LICOLA, or LAGO-DI-LICOLA, a lake in the kingdom of Naples, formerly famous for plenty of excellent fish; but in the year 1538 an explosion of a volcano changed one part of it into a mountain of ashes, and the other into a morass. It was anciently known by the name of the Lucrine-lake.

LICONIA, in botany: A genus of the digynia order, belonging to the pentandria class of plants. There are five petals inlaid in the pit of the nectarium at its base; the capsule is bilocular and seed-bearing.

LICTORS, among the Romans, were officers established by Romulus, who always attended the chief magistrates when they appeared in public.

The duty of their office consisted in the three following particulars: 1. *Submotio*, or clearing the way for the magistrate they attended: this they did by word of mouth; or, if there was occasion, by using the rods they always carried along with them. 2. *Animadversio*, or causing the people to pay the usual respect to the magistrate, as to alight, if on horseback or in a chariot; to rise up, uncover, make way, and the like. 3. *Præatio*, or walking before the magistrates: this they did not confusedly, or altogether, nor by two or three abreast, but singly following one another in a straight line. They also preceded the triumphal car in public triumphs; and it was also part of their office to arrest criminals, and to be public executioners in beheading, &c. Their ensigns were the *FASCES* and *SECURIS*.

As to the number of lictors allowed each magistrate, a dictator had twenty-four, a master of the horse six, a consul twelve, a prætor six; and each vestal virgin, when she appeared abroad, had one.

LIDD. See LYDD.

LIDDEL (Dr Duncan), professor of mathematics and of medicine in the university of Helmstadt, was born in the year 1561 at Aberdeen, where he received the first part of his education in languages and philosophy. About the age of eighteen he repaired to the university of France, where he spent three years in a diligent application to mathematics and philosophy. From France he proceeded to Wratisslaw, or Breslaw, in Silesia, where

he is said to have made uncommon progress in his favourite study of mathematics, under the direction of a very eminent professor, Paulus Wittichius. Having studied at Breslaw for the space of one year, he returned to Francfort, and remained there three years, paying the most intense application to the study of physic. A contagious distemper having broke out at that place, the students were dispersed, and Liddel retired to the university of Rostock. Here he renewed his studies, rather as a companion than as a pupil of the celebrated Bruceus, who, though an excellent mathematician, did not scruple to confess that he was instructed by Liddel in the more perfect knowledge of the Copernican system, and other astronomical questions. In 1590 he returned once more to Francfort. But having there heard of the increasing reputation of the Academia Julia, established at Helmstadt by Henry duke of Brunswick, Mr Liddel removed thither; and soon after his arrival was appointed to the first or lower professorship of mathematics. From thence he was promoted to the second and more dignified mathematical chair, which he occupied for nine years, with much credit to himself and to the Julian Academy. In 1596 he obtained the degree of M. D. was admitted a member of that faculty, and began publicly to teach physic. By his teaching and his writings he was the chief support of the medical school at Helmstadt; was employed as first physician at the court of Brunswick, and had much practice among the principal inhabitants of that country. Having been several times elected dean of the faculties both of philosophy and physic, he had in the year 1604 the honour of being chosen professor of the university. But neither academical honours, nor the profits of an extensive practice abroad, could make Dr Liddel forget his native country. In the year 1600 he took a final leave of the Academia Julia; and after travelling for some time through Germany and Italy, he at length settled in Scotland. He died in the year 1613, in the fifty-second year of his age. By his last will he bestowed certain lands purchased by him near Aberdeen upon the university there, in all time coming, for the education and support of six poor scholars. Among a variety of regulations and injunctions for the management of this charity, he appoints the magistrates of Aberdeen his trustees, and solemnly denounces the curse of God on any person who shall abuse or misapply it. His works are, 1. *Disputationes Medicinales, Helmstadt, 1603, 4to.* 2. *Arts Medicae succincte et perspicue explicatae, Hamburgi, 1607, 8vo.* This performance is dedicated to king James VI. and is divided into five books, viz. *Introductio in totam Medicinam; De Physiologia; De Pathologia; De Signorum doctrina; De Therapeutica.* 3. *De Febrilibus Libri tres, Hamburgi, 1610, 12mo.* 4. *Tractatus de dentibus aureis, Hamburgi, 1628, 12mo.* This last performance Dr Liddel published in order to refute a ridiculous story then current of a poor boy in Silesia, who, at seven years of age, having lost some of his teeth, brought forth, to the astonishment of his parents, a new tooth of pure gold. Jacobus Horstius, doctor and professor of medicine in the Academia Julia, at the same time with our author, had published a book, which he dedicated to the Emperor Rudolphus II. to prove that this wonderful tooth was a prodigy sent from heaven to encourage the Germans then at war with the Turks, and foretelling, from this golden tooth, the future victories of the Christians, with the final destruction of the Turkish empire

and Mahometan faith, and a return of the golden age in 1700, preparatory to the end of the world. The imposture was soon after discovered to be a thin plate of gold, skilfully drawn over the natural tooth by an artist of that country, with a view to excite the public admiration and charity. 5. *Artis conferendi Sanitatem, libri duo, Aberdonie, 1651, 12mo.*; a posthumous work. The merit of these works of Dr Liddel, it is not now necessary to estimate with precision. They appear, however, to contain the most fashionable opinions and practice, in the medical art, of the age in which he lived; nor is there almost any disease or medical subject then known of which he has not treated in one or other of his writings. Of his language it may be sufficient to observe, that the Latin is at least as pure as is generally found among medical writers, and that his style is plain and perspicuous, and sometimes even elegant.

LIDFORD, a village of Devonshire in England, situated on the river Lid, two or three miles east of Brent Tor, was formerly a famous town, with a castle, which was always committed to men of quality, and twice sent burgesses to parliament. It was sadly shattered by the Danes in 997: and though now a contemptible village, the parish may for lands and liberties compare with any in the kingdom, the whole forest of Dartmore being in the verge of it. The river here being pent up at the bridge with rocks, has made itself so deep a fall, by its continual working, that passengers only hear the noise of the water without seeing it.

LIDKOPING, a town of West Gothland in Sweden, seated on the lake Wenar, in E. Long. 13. 40. N. Lat. 58. 25.

LIDNEY, a town of Gloucestershire in England, 71 miles from London, is seated on the west bank of the river Severn, and has a market on Wednesdays, with two fairs in the year. In the neighbourhood are the remains of a large Roman encampment, with foundations of many ancient buildings, among which are the ruins of a Roman hypocaust of an oval form, and Roman antiquities and coins are often found here in great number. Mr Bathurst has a fine seat here called *Sydney-Park*, with very extensive woods adjoining.

LIE, in morals, denotes a criminal breach of veracity. — Archdeacon Paley, in treating of this subject, observes, that there are falsehoods which are not lies; that is, which are not criminal: and there are lies which are not literally and directly false.

I. Cases of the first class are those, 1. Where no one is deceived: as for instance in parables, fables, novels, jests, tales to create mirth, or ludicrous embellishments of a story, in which the declared design of the speaker is not to inform, but to divert; compliments in the subscription of a letter; a prisoner's pleading not guilty; an advocate asserting the justice, or his belief of the justice, of his client's cause. In such instances no confidence is destroyed, because none was reposed; no promise to speak the truth is violated, because none was given or understood to be given. 2. Where the person you speak to has no right to know the truth, or more properly where little or no inconvenience results from the want of confidence in such cases; as where you tell a falsehood to a madman for his own advantage; to a robber to conceal your property; to an assassin to defeat or to divert him from his purpose. It is upon this principle, that, by the laws of war, it is allowed to deceive an enemy by feints, false colours,

Lie
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Li gr.

Liege.

spies, false intelligence, and the like: but, by no means, in treaties, truces, signals of capitulation, or surrender: and the difference is, that the former supposes hostilities to continue, the latter are calculated to terminate or suspend them.

Many people indulge in serious discourse a habit of fiction and exaggeration, in the accounts they give of themselves, of their acquaintance, or of the extraordinary things which they have seen or heard; and so long as the facts they relate are indifferent, and their narratives though false are inoffensive, it may seem a superstitious regard to truth to censure them merely for truth's sake. Yet the practice ought to be checked: for, in the first place, it is almost impossible to pronounce beforehand, with certainty, concerning any lie, that it is inoffensive; or to say what ill consequences may result from a lie apparently inoffensive: And, in the next place, the habit, when once formed, is easily extended to serve the designs of malice or interest; like all habits, it spreads indeed of itself. Pious frauds, as they are improperly enough called, pretend inspirations, forged books, counterfeit miracles, are impositions of a more serious nature. It is possible that they may sometimes, though seldom, have been set up and encouraged with a design to do good: but the good they aim at requires, that the belief of them should be perpetual, which is hardly possible; and the detection of the fraud is sure to disparage the credit of all pretensions of the same nature. Christianity has suffered more injury from this cause than from all other causes put together.

II. As there may be falsehoods which are not lies, so there may be lies without literal or direct falsehood. An opening is always left for this species of prevarication, when the literal and grammatical signification of a sentence is different from the popular and customary meaning. It is the wilful deceit that makes the lie; and we wilfully deceive, when our expressions are not true, in the sense in which we believe the hearer apprehends them. Besides, it is absurd to contend for any sense of words, in opposition to usage; for all senses of all words are founded upon usage, and upon nothing else. Or a man may act a lie; as by pointing his finger in a wrong direction, when a traveller inquires of him his road; or when a tradesman shuts up his windows, to induce his creditors to believe that he is abroad: for to all moral purposes, and therefore as to veracity, speech and action are the same; speech being only a mode of action.

LIECHTENAU, a town of Germany, in the circle of Franconia and margravate of Anspach, subject to Nuremberg. E. Long. 9. 5. N. Lat. 48. 43.

LIEGE (*Ligius*), in law, properly signifies a vassal, who holds a kind of fee, that binds him in a closer obligation to his lord than other people.

The term seems to be derived from the French *lier* "to bind;" on account of a ceremony used in rendering faith or homage; which was by locking the vassal's thumb or his hand in that of the lord, to show that he was fast bound by his oath of fidelity. Cujas, Vigenere, and Bignon, choose rather to derive the word from the same source with *leudis* or *leodi*, "loyal, faithful." But Du Cange falls in with the opinion of those who derive it from *liti*, a kind of vassals, so firmly attached to their lord, on account of lands or

fees held of him, that they were obliged to do him all manner of service, as if they were his domestics. He adds, this was formerly called *litium servitium*, and the person *lige*. In this sense, the word is used, Leg. Edw. cap. 29. *Judei sub tutela regis ligea debent esse*; that is, wholly under his protection.

By liege homage, the vassal was obliged to serve his lord towards all, and against all, excepting his father. In which sense, the word was used in opposition to simple homage; which last only obliged the vassal to pay the rights and accustomed dues to his lord; and not to bear arms against the emperor, prince, or other superior lord: so that a liege man was a person wholly devoted to his lord, and entirely under his command. *Omnibus, &c. Reginaldus, rex Insularum, salutem. Sciatis quod deveni homo ligeus domini regis Anglie Johannis, contra omnes mortales, quamdiu visco; & inde ei fidelitatem & sacramentum prestavi, &c.* MS. penes W. Dugdale.

But it must be observed, there were formerly two kinds of liege homage: the one, by which the vassal was obliged to serve his lord, against all, without exception even of his sovereign; the other, by which he was to serve him against all, except such other lords as he had formerly owed liege homage to.

In our old statutes lieges, and liege people, are terms peculiarly appropriated to the king's subjects; as being *liges*, *ligi*, or *ligati*, obliged to pay allegiance to him; 8 Henry VI. 14 Hen. VIII. &c. though private persons had their lieges too. *Reinaldus, Dei gratia, abbas Ramseie, presbiter & hominibus de Brancestre, & omnibus vicinis Francis & Anglis, salutem. Sciatis me dedisse terram Ulst, in depedene (hodie depedate) huic Boselino, & uxori ejus Alstine—ea condicione quod effecti sint homines liberi.* Lib. Ramef.

LIEGE-Pouffe, in Scots law, is opposed to deathbed; and signifies a person's enjoying that state of health in which only he can dispose of his property at pleasure.

LIEGE, a bishopric of Germany, in the circle of Westphalia; bounded to the north by Brabant, to the south by Champagne and Luxemburg, to the east by Limburg and Juliers, and to the west by Brabant, Namur, and Hainault. It is very unequal both in length and breadth; the former being in some places above 90 miles, in others not half so much; and the latter in some places 45, in others hardly 25. The air here is very temperate; and the soil fruitful in corn, wine, wood, and pasture. Here also are mines of lead and iron, pits of coal, quarries of marble and stone, and some celebrated mineral waters, as those of Spa and Chau-fontaine. The principal rivers are, the Maes and Sambre. The manufactures and commodities of the country are chiefly beer, arms, nails, serge, leather, with the products we have just mentioned. The states of the bishopric are composed of three bodies: the first is the chapter of Liege; the second, the nobility of the country; and the third, the deputies of the capital and the other towns. The three estates are seldom called together, except to raise taxes for the service of the province, or upon some particular emergency; but there is a committee of the states, who meet thrice a-week, and in time of war daily. They are always about the prince-bishop, to make remonstrances, and demand the redress of grievances. The bishop is spiritual and temporal lord

of.

Liege.

of the whole country; but, as bishop, is suffragan to the archbishop of Cologne. He styles himself, *by the grace of God, bishop and prince of Liege, duke of Bouillon, marquis of Franchimont, count of Loos, Hoorn, &c.* His arms for Liege are, a pillar argent, on a pedestal of the same, with a crown or, in a field ruby. In the matricula he was formerly rated at 50 horse and 170 foot; or 1280 florins monthly, in lieu of them, but now only at 826. An abatement of one third has also been granted of the ancient assisement to the chamber-court, which was 360 rix-dollars 62½ knitzers for each term. Here are several colleges which sit at Liege, for the government of the country, and the decision of causes, civil, criminal, spiritual, and feudal, and of such also as relate to the finances. The chapter consists of 60 persons, who must either prove their nobility for four generations, both by father and mother, before they can be admitted: or if they cannot do that, must at least have been doctors or licentiates of divinity for seven years, or, of law, for five years, in some famous university. The bishopric is very populous and extensive, containing 1500 parishes, in which are 24 walled towns, besides others, 52 baronies, besides counties and seigniories, 17 abbeys for men, who must be all gentlemen, and 11 for ladies, exclusive of others.

LIEGE, the capital of the bishopric of the same name, stands upon the Maes, in a fine valley, surrounded with woods and hills, being a free imperial city, and one of the largest and most eminent in Europe. Though it is 100 miles from the sea by water, the Maes is navigable up to it. The city has 16 gates; 17 bridges, some of them very handsome; 154 streets, many of them straight and broad; a fine episcopal palace; a very large stately cathedral, in which, besides five great silver coffers full of reliques, are several silver statues of saints, and a St George on horseback of massy gold, presented to the cathedral by Charles the Bold, by way of atonement for using the inhabitants cruelly in the year 1468. Of the other churches, that of St Paul is the most remarkable, both for its structure and fine ornaments in painting and marble. The city is well fortified, and there are also two castles on the mountain of the Holy Walburg for its defence. Besides a great number of other convents of both sexes, here is a college of English Jesuits, founded in the year 1616, and a fine nursery of English ladies. Indeed, churches, convents, and other religious foundations, take up the greater part of it. The reader, therefore, no doubt, will take it for granted, that it is a most blessed, holy, and happy city. But however it may fare with the profane, unhallowed laity, it is certainly the paradise of priests, as it is expressly called, by way of eminence. It is divided into the old and new, or the upper and lower; and the latter again into the island, and the quarter beyond the Maes. The houses are high, and built of bluish marble. In the town and suburbs are 12 public places or squares, 10 hospitals, a beguin-house, and two fine keys, planted with several rows of trees, for the burghers to take the air; but a great part of that within the walls is taken up with orchards and vineyards. The manufactures of this city are arms, nails, leather, serge, and beer. In St William's convent, without the city, is the tomb of the famous

Liege.

English traveller Sir John Mandeville, with an inscription in barbarous French, requesting those who read it to pray for his soul. Near it are kept the fiddle, spurs, and knife, that he made use of in his travels. After having seen most of the cities of any note in the world, he made choice of this to spend the eve of his life in. A little way from the city, on the other side the Maes, stands the episcopal palace of Seraing, in which the bishops generally reside during the summer. The latitude of this city is 50. 36. N. and the longitude 5. 40. E.

Some disturbances took place here in the year 1789, in consequence of certain disputes that had arisen between the prince-bishop and the inhabitants. The latter having demanded certain privileges, which he did not think proper to grant, they took up arms, and compelled him and his chapter to comply with their request. The prince, together with many of the clergy, nobility, and citizens, alarmed by this commotion, and dreading the consequences of popular fury, which when once roused, seldom knows any bounds, sought safety by a voluntary exile. They then appealed to the imperial chamber; and this tribunal, instead of acting the part of arbiter, decided as a sovereign, and ordered the circles of the Lower Rhine and Westphalia to execute the sentence.

The king of Prussia, at whose court one of the chiefs of the insurrection had resided, and who wished to gain a party at Liege, became mediator; and seemed to favour the Liegeois, many of whose claims were just, though they attempted to enforce them by violence and the most illegal steps. Intoxicated with this protection, the people of Liege treated the remonstrances of their bishop, the decrees of the imperial chamber, and the resolutions of the directory of the two circles, with the utmost contempt; and proceeded so far as even to dethrone their prince, by appointing a regent in the person of a French prelate. The electoral college having deliberated on the best means of putting an end to these disturbances, its propositions, though modified by M. Dolm the Prussian plenipotentiary, made the insurgents break out into open sedition. Deluded by their leaders, they gave themselves up every day to new excesses; the effects of the citizens were exposed to pillage, and their persons to insult. The king of Prussia, who was desirous to bring matters to an accommodation, and not to instigate the Liegeois to become independent, finding that the efforts of his minister were not attended with the desired success, seemed unwilling to interfere any farther in an affair which might have led him into a quarrel with the empire. The executive troops, at the same time, remained almost in a state of inactivity; and seemed rather to guard the frontiers of this petty state, than to make any attempt to reduce it to obedience. Neither this conduct, however, nor the exhortations of Prussia, added to the moral certainty of their being soon compelled to lay down their arms, made any change in the conduct of the malecontents. They declared openly, in the face of all Europe, that they would either conquer or die; and they persisted in this resolution, while commerce, manufactures, and the public revenues, were going daily to decay.

Having at length openly attacked the executive forces without the territories of their city, the emperor could no longer remain an indifferent spectator. He

Liege,
Lievens.

was now full time to put a period to that madness to which the people had abandoned themselves; and to accomplish this in an effectual manner, the imperial chamber at Wetzlar requested the emperor, as a member of the ancient circle of Burgundy, to execute its orders respecting this object. In consequence of this measure, Baron Alvinzi, who commanded a body of Austrians cantoned in Limburgh and the confines of Brabant, notified, by order of Marshal Bender, to the states and municipality of Liege, that the emperor intended to send troops into their city and territories, for the purpose of restoring tranquillity and good order. The states had already been informed of this resolution by their agent at Wetzlar. They therefore wrote to Marshal Bender, to assure him of the respectful confidence which they placed in the justice and magnanimity of the emperor, and to request that the Austrian troops might enter alone, without those of the electors; and that they might be confined to occupy the gates and the suburbs only. To this letter, which was carried to Brussels by a deputation of the states, Marshal Bender returned a very satisfactory answer, relating to the disposition of the electoral troops: but Baron Alvinzi, in a note which he wrote to the states, insisted among other articles, that all the citizens should throw down their arms; that proper accommodations should be prepared for the officers and men; that the warlike stores, collected for making resistance, should be removed; and that cockades, and every other distinctive mark of the like kind, should be laid aside before the arrival of the Imperial troops. However humiliating these preliminaries might be, especially that of a general disarming, the states and municipalities acquiesced without the least reserve; and their submission, as sudden as complete, was communicated to the people, with an exhortation to follow their example.

Notwithstanding this pacific appearance, two days before the entrance of the Imperial troops, the municipal council of Liege, flattering themselves, perhaps, with the hopes of assistance from Prussia, assured the inhabitants that they would remain unshaken in their post, and that they had sworn never to desert the cause in which they were engaged. This, however, did not prevent the Austrian troops, to the number of 6000, from penetrating, without opposition, into the heart of the city; where they occupied every post; made the citizens lay aside their arms, uniforms, and cockades; and, in a single hour, dethroned so many sovereigns of a year. The greater part of the municipal officers, who, two days before, had solemnly promised such great things, betook themselves to flight, and retired either to France or Wesel; while the ancient magistracy, which had been expelled in the month of August 1789, was provisionally re-instated by the directorial commissioners.—The decrees of the imperial chamber at Wetzlar have since been executed in their utmost extent. The ancient magistracy and the privy-council of the prince bishop have been restored; and the prince himself having returned, peace and good order have been re-established.

LIENTERY, a flux of the belly, in which the aliments are discharged as they are swallowed, or very little altered either in colour or substance. See (*Index* subjoined to) **MEDICINE**.

LIEVENS (John or Jan), a celebrated painter, was Vol. X. Part I.

Lieou-
Kieou.

born at Leyden in 1607. He discovered an early inclination for the arts, and was the disciple first of Joris van Schooten, and afterwards of Peter Lastman. He excelled principally in painting portraits; but he also executed several historical subjects with great success. He came over into England, where he resided three years, and painted the portraits of Charles I. the queen, the prince of Wales, and several of the nobility; after which he returned to Antwerp, where he met with full employment for his pencil. We have several etchings by this master, which are performed in a slight, but masterly manner. The chiaro scuro is very skillfully managed in them, so as to produce a most powerful effect. His style of etching bears some resemblance to that of Rembrandt; but it is coarser in general, and less finished.

LIEOU-KIEOU, the name of certain islands of Asia, subject to China; but hitherto little known to geographers, who have been satisfied with marking their existence and latitude in their charts. They, however, form a powerful and extensive empire, the inhabitants of which are civilized, and ought not to be confounded with other savage nations dispersed throughout the islands of Asia. Father Gabil, a Jesuit, has furnished us with some interesting details respecting these islanders, which he extracted from a Chinese relation, published in 1721, at the end of a voyage that was undertaken on the following account. The emperor Kang-hi having resolved, in 1719, to send an ambassador to the king of Lieou-kieou, chose for this purpose one of the great doctors of the empire, named *Supao-Koang*. This learned man departed from China in 1719, and returned to Peking in 1720, where, in the year following, he caused a relation of his voyage to be published in two volumes. It is in the first of these that he gives an accurate and particular description of the isles of Lieou-kieou; and what he relates appears to be worthy of the greater credit, because, being on the spot, he examined, as he himself says, according to the orders of the emperor, whatever he found curious or interesting, respecting the number, situation, and productions of these isles; as also the history, religion, manners, and customs of the people who inhabit them.

These isles, situated between Corea, Formosa, and Japan, are in number 36. The principal and largest is called *Lieou-kieou*; the rest have each a particular denomination. The largest island extends from north to south almost 440 lys, and 120 or 130 from east to west; but on the south side, the extent from east to west is not 100 lys. The south-east part of the island, where the court resides, is called *Cheouli*; and it is there that Kint-ching, the capital city, is situated. The king's palace, which is reckoned to be four leagues in circumference, is built on a neighbouring mountain. It has four gates, which correspond to the four cardinal points; and that which fronts the west forms the grand entry. The view which this palace commands is most extensive and delightful; it reaches as far as the port of Napakiang, at the distance of ten lys, to the city of Kint-ching, and to a great number of other cities, towns, villages, palaces, temples, monasteries, gardens, and pleasure-houses. It stands in longitude 145° 26 east, and in latitude 26° 2' north.

If we believe these islanders, the origin of their empire

Lieou-
Kieou.

pire is lost in the remotest antiquity. They reckon up 25 successive dynasties, the duration of which forms a period of more than 18,000 years. It would be useless to employ a single moment in pointing out the absurdity of these pretensions. It is however certain, that the existence of the country called *Lieou-kieou* was not known in China before the year 605 of the Christian era. It was in the course of that year, that one of the emperors of the dynasty of Soui, having heard of these isles, was desirous of knowing their situation. This prince at first sent some Chinese thither; but their expedition proved fruitless, as the want of interpreters prevented them from acquiring that knowledge which was the object of their voyage. They only brought some of the islanders with them to Sigan-fou, the capital of the province of Chen-si, which was the usual residence of the emperors of the dynasty of Soui. It fortunately happened, that an ambassador of the king of Japan was then at court. This ambassador and his attendants immediately knew the strangers to be natives of *Lieou-kieou*; but they spoke of these isles as of a miserable and wretched country, the inhabitants of which had never been civilized. The emperor of China afterwards learned, that the principal island lay to the east of a city called at present *Fou-tcheou-fou*, which is the capital of the province of Fo-kien; and that, in a passage of five days, one might reach the large island where the king kept his court.

On this information, the emperor Yang-ti sent skillful men, accompanied by interpreters, to summon the prince to do homage to the emperor of China, and to pay him tribute. This proposal was very ill received. The king of *Lieou-kieou* sent back the Chinese, telling them, sternly, that he acknowledged no prince to be his superior. This answer irritated the emperor, who, to obtain revenge, caused a fleet to be immediately equipped in Fo-kien, in which he embarked 10,000 men. This fleet set sail, and arrived in safety at the port of Napa-kiang. The army, in spite of every effort made by the natives, landed on the island; and the king, who had put himself at the head of his troops to oppose the enemy, having fallen in battle, the Chinese pillaged, sacked, and burnt the royal city, made more than 5000 slaves, and returned to China.

The emperors of the dynasty of Tang, those of the short dynasties that followed, and those of the dynasty of Song, although they were fully informed of every thing respecting the *Lieou-kieou* isles, made no attempts to render them tributary. In 1291, Chi-fou, emperor of the dynasty of Yen, was desirous of reviving the pretensions of his predecessors. He fitted out a fleet to subdue these islands; but schemes of conquest had become disagreeable to the Chinese, since the disaster that befel their army in an expedition against Japan. The fleet of Chi-fou went no farther than the isles of Pong-hou, and the western coast of Formosa, from whence, under divers pretences, they returned to the ports of Fo-kien.

It was only in 1372, under the reign of Hong-vou, founder of the dynasty of Ming, that these islands submitted voluntarily to the Chinese government. Hong-vou had sent one of the grandes of his court to T'fay-tou, who was then reigning at *Lieou-kieou*, to inform him of his accession to the throne. The Chinese nobleman had received particular instructions respecting this

Lieou-
Kieou.

commission, and he acquitted himself of it with all the prudence and address of an able minister. In a private audience which he had with T'fay-tou, he exhorted this prince to declare himself a tributary of the empire, and laid before him the advantages he would derive from this step. His reasoning, supported by the power of his natural eloquence, made so much impression on the mind of T'fay-tou, that he embraced the proposal made him, and sent immediately to the emperor to demand the investiture of his states.

Hong-vou received his envoys in a magnificent manner, and loaded them with presents. He solemnly declared T'fay-tou a vassal of the empire; and, after having received his first tribute (which consisted in valuable horses, aromatic wood, sulphur, copper, tin, &c.) he sent to this prince a golden seal, and confirmed the choice he had made of one of his sons for successor. The emperor afterwards sent 36 families, almost all from the province of Fo-kien to *Lieou-kieou*. T'fay-tou received them, assigned them lands near the port of Napa-kiang, and appointed certain revenues for their use, at the same time that Hong-vou made them considerable remittances. These families first introduced into *Lieou-kieou* the learned language of the Chinese, the use of their characters, and the ceremonies practised in China in honour of Confucius. On the other hand, the sons of several of the grandes of the court of T'fay-tou were sent to Nan-king, to study Chinese in the imperial college, where they were treated with distinction, and maintained at the emperor's expences.

The isles of *Lieou-kieou* had neither iron nor porcelain. Hong-vou supplied this want; he caused a great number of utensils of iron and instruments to be made, which he sent thither, together with a quantity of porcelain vessels. Commerce, navigation, and the arts soon began to flourish. These islanders learned to cast bells for their temples, to manufacture paper and the finest stuffs, and to make porcelain, with which they had been supplied before from Japan.

The celebrated revolution which placed the Tartars on the imperial throne of China, produced no change in the conduct of the kings of *Lieou-kieou*. Chang-tché, who was then reigning, sent ambassadors to acknowledge Chun-tchi, and received a seal from him, on which were engraven some Tartar characters. It was then settled, that the king of *Lieou-kieou* should pay his tribute only every two years, and that the number of persons in the train of his envoys should not exceed 150.

The emperor Kang-hi seemed to pay more attention to these isles than any of his predecessors. He caused a superb palace to be erected in honour of Confucius, and a college where he maintained masters to teach the sciences and the Chinese characters. He also instituted examinations for the different degrees of the literati. He ordained, that the king of *Lieou-kieou* should never send in tribute rose-wood, cloves, or any other production which was not really of the growth of the country; but that he should send a fixed quantity of sulphur, copper, tin, shells, and mother of pearl, which is remarkably pretty in these islands. He permitted, that, besides the usual tribute, he might present him horse-furniture, pistol-cases, and other things of the same kind, which these islanders are said to manufacture with great taste and neatness.

Lieuou-
Kieou.

It is more than 900 years since the bonzes of China introduced at Lieou-kieou the worship of Fo, and the principal books belonging to their sect. This worship is at present the established religion both of the grantees and of the people. There is still to be seen in the royal city a magnificent temple, erected in honour of another idol borrowed from the Chinese, named *Tsin-sey*, which signifies *celestial queen or lady*.

These islanders do not make promises or swear before their idols. When they have occasion to do this, they burn perfumes, present fruits, and stand respectfully before some stone, which they call to witness the solemnity of their engagements. Numbers of stones are to be seen in the courts of their temples, in most public places, and upon their mountains, which are entirely appropriated to this purpose. They have also among them women consecrated for the worship of spirits, who are supposed to have great influence over these beings. They visit the sick, distribute medicines, and recite prayers for their recovery.

They respect the dead as much as the Chinese, and they are no less ceremonious in wearing mourning; but their funerals are neither so pompous, nor attended with so much expence. Their coffins, which are of an hexagonal or octagonal figure, are three or four feet high. They burn the flesh of the bodies of their dead, and preserve only the bones. They never offer provisions to them; they are contented with placing lamps round them, and burning perfumes.

Different families are distinguished in Lieou-kieou by surnames, as in China; but a man and a woman of the same surname cannot be united in marriage. The king is not permitted to marry but in the three grand families, which always enjoy the highest offices. There is a fourth, of equal distinction to the three former; but neither the king nor the princes contract any alliances with this family; for it is doubtful, whether it be not sprung from the same stem as the royal line.

A plurality of wives is allowed in these isles. Young men and young women enjoy the liberty of seeing one another, and of conversing together; and their union is always in consequence of their own choice. The women are very reserved; they never use paint, and wear no pendants in their ears; they collect their hair on the top of their heads in the form of a curl, and fix it in that manner by means of long pins made of gold or silver.

Besides the vast domains which the king possesses, he receives the produce of all the sulphur, copper, and tin-mines, and of the salt-pits, together with what arises from taxes. From these revenues he pays the salaries of the mandarins and officers of his court. These salaries are estimated at a certain number of sacks of rice; but under this name is comprehended whatever the king gives in grain, rice, silk, cloth, &c. The whole is valued according to the price of the sacks of rice.

There are here, as in China, nine orders of mandarins, who are distinguished by the colour of their caps, or by their girdles and cushions. The greater part of the titles of these mandarins are hereditary in their families; but there are some which are only bestowed upon merit. In the royal city there are tribunals established for managing the revenue and affairs of the principal island, and of all the others which are dependent

on it. The latter have agents, who reside at court. There are also particular tribunals for civil and criminal matters; for whatever concerns the families of the grantees and princes; for the affairs of religion; for inspecting the public granaries, king's revenues, duties; for commerce, manufactures, civil ceremonies, and for navigation, public edifices, literature, and war.

The vessels that are built in this country are greatly valued by the people of China and Japan. In these the natives go not only from one island to another, but also to China, Tong-king, Cochinchina, Corea, Nangaza-ki, Satsuma, the neighbouring isles, and to Formosa, where they dispose of their different commodities. Besides those articles of commerce which their manufactures of silk, cotton, paper, arms, copper utensils, &c. furnish them, they also export mother of pearl, tortoise and other shells, coral and whet-stones, which are in great request both in China and Japan.

LIEUTAUD (Dr Joseph), counsellor of state and first physician at the court of France, was born at Aix in Provence, and resided principally there till he took the degree of doctor of medicine. After this he prosecuted his studies for some years at Montpellier. He returned to Aix, where he soon acquired extensive practice, and became eminent for literary abilities. He resided there till the year 1750, when he was invited to act as physician to the royal infirmary at Versailles. There he practised with such reputation and success, that he soon arrived at the head of his profession; and in the year 1774, upon the death of M. Senac, he was appointed archiater. His extensive engagements in practice did not prevent him from cultivating the science of medicine in all its branches, and from freely communicating to others the result of his own studies. He published many valuable works; amongst which the following may be accounted the most remarkable. 1. *Elementa Philologiae*. 2. *Precis de la Medecine*. 3. *Pratique Precis de la Matière Medicale*. 4. *Essais Anatomique*. 5. *Synopsis Universæ Praxeos Medicinæ*. 6. *Historia Anatomico-Medicæ*. He died at Versailles in 1780, aged 78 years.

LIEUTENANT, an officer who supplies the place and discharges the office of a superior in his absence. Of these, some are civil, as the lords lieutenants of kingdoms, and the lords-lieutenants of counties; and others are military, as the lieutenant-general, lieutenant-colonel, &c.

Lord LIEUTENANT of Ireland, is properly a viceroy; and has all the state and grandeur of a king of England, except being served upon the knee. He has the power of making war and peace, of bestowing all the offices under the government, of dubbing knights, and of pardoning all crimes except high treason; he also calls and prorogues the parliament, but no bill can pass without the royal assent. He is assisted in his government by a privy-council; and, on his leaving the kingdom, he appoints the lords of the regency, who govern in his absence.

Lord LIEUTENANTS of Counties, are officers, who, upon any invasion or rebellion, have power to raise the militia, and to give commissions to colonels and other officers, to arm and form them into regiments, troops, and companies. Under the lord-lieutenants, are deputy-lieutenants, who have the same power:

Lieutaud,
Lieutenant.

LIEUTENANT—these are chosen by the lords-lieutenants, out of the principal gentlemen of each county, and presented to the king for his approbation.

LIEUTENANT-Colonel. See COLONEL.

LIEUTENANT-General. See GENERAL.

LIEUTENANT, in the land-service, is the second commissioned officer in every company of both foot and horse, and next to the captain, and who takes the command upon the death or absence of the captain.

LIEUTENANT of Artillery. Each company of artillery hath four; 1 first and 3 second lieutenants. The first lieutenant hath the same detail of duty with the captain; because in his absence he commands the company; he is to see that the soldiers are clean and neat; that their clothes, arms, and accoutrements, are in good and serviceable order; and to watch over every thing else which may contribute to their health. He must give attention to their being taught the exercise, see them punctually paid, their messes regularly kept, and to visit them in the hospitals when sick. He must assist at all parades, &c. He ought to understand the doctrine of projectiles and the science of artillery, with the various effects of gun-powder, however managed or directed; to enable him to construct and dispose his batteries to the best advantage; to plant his cannon, mortars, and howitzers, so as to produce the greatest annoyance to an enemy. He is to be well skilled in the attack and defence of fortified places; and to be conversant in arithmetic, mathematics, mechanics, &c.

Second **LIEUTENANT in the Artillery**, is the same as an ensign in an infantry regiment, being the youngest commissioned officer in the company, and must assist the first lieutenant in the detail of the company's duty. His other qualifications should be equal with those of the first lieutenant.

LIEUTENANT of a ship of War, the officer next in rank and power to the captain, in whose absence he is accordingly charged with the command of the ship, as also the execution of whatever orders he may have received from the commander relating to the king's service.

The lieutenant who commands the watch at sea, keeps a list of all the officers and men thereto belonging, in order to muster them when he judges it expedient, and report to the captain the names of those who are absent from their duty. During the night-watch, he occasionally visits the lower decks, or sends thither a careful officer, to see that the proper centinels are at their duty, and that there is no disorder amongst the men; no tobacco smoked between decks, nor any fire or candles burning there, except the lights which are in lanterns, under the care of a proper watch, on particular occasions. He is expected to be always upon deck in his watch, as well to give the necessary orders with regard to trimming the sails and superintending the navigation, as to prevent any noise or confusion; but he is never to change the ship's course without the captain's directions, unless to avoid an immediate danger.

The lieutenant, in time of battle, is particularly to see that all the men are present at their quarters, where they have been previously stationed according to the regulations made by the captain. He orders and exhorts them every where to perform their duty;

and acquaints the captain at all other times of the misbehaviour of any person in the ship, and of whatever else concerns the service or discipline.

The youngest lieutenant in the ship, who is also styled *lieutenant at arms*, besides his common duty, is particularly ordered, by his instructions, to train the seamen to the use of small arms, and frequently to exercise and discipline them therein. Accordingly his office, in time of battle, is chiefly to direct and attend them; and at all other times to have a due regard to the preservation of the small arms, that they be not lost or embezzled, and that they are kept clean and in good condition for service.

LIEUTENANT-Reformed, he whose company or troop is broke or disbanded, but continued in whole or half-pay, and still preserves his right of seniority and rank in the army.

LIFE, is peculiarly used to denote the animated state of living creatures, or the time that the union of their soul and body lasts.

The *Prolongation of Life* is made by Lord Bacon one of the three branches of medicine; the other two relating to the preservation of health, and the cure of diseases. See **MEDICINE**.

The theory of prolonging life he numbers among the desiderata. Some means or indications that seem to lead to it, he lays down as follow.

Things are preserved in two manners; either in their *identity*, or by *reparation*. In their *identity*, as a fly or ant in amber; a flower, or fruit, or wood, in a conservatory of snow; a dead carcase in balsams. By *reparation*; as a flame, or a mechanical engine, &c. To attain to the prolongation of life, both these methods must be used. And hence, according to him, arise three intentions for the prolongation of life: *Retardation* of consumption, proper *reparation*, and *renovation* of what begins to grow old.

Consumption is occasioned by two kinds of depredation; a depredation of the innate spirit, and a depredation of the ambient air. These may be each prevented two ways; either by rendering those agents less predatory, or by rendering the passive parts (*viz.* the juices of the body) less liable to be preyed on. The spirit will be rendered less predatory, if either its substance be condensed, as by the use of opiates, grief, &c.; or its quantity diminished, as in spare and molar diets; or its motion calmed, as in idleness and tranquillity. The ambient air becomes less predatory, if it be either less heated by the rays of the sun, as in cold climates, in caves, mountains, and anchorets cells; or be kept off from the body, as by a dense skin, the feathers of birds, and the use of oils and unguents without aromatics. The juices of the body are rendered less liable to be preyed on, either by making them harder or more moist and oily; harder, as by a coarse sharp diet, living in the cold, robust exercises, and some mineral baths; softer, as by the use of sweet foods, &c. abstaining from salts and acids; and especially by such a mixture of drink as consists wholly of fine subtile particles, without any acrimony or acidity.

Reparation is performed by means of aliment; and alimentation is promoted four ways: By the concoction of the viscera, so as to extrude the aliment; By exciting the exterior parts to the attraction of the aliment; as in proper exercises and frictions, and some unctions and

Life,
Ligature.Ligature,
Light.

and baths : By the preparation of the food itself, so as it may more easily insinuate itself, and in some measure anticipate the digestion ; as in various ways of dressing meats, mixing drinks, fermenting breads, and reducing the virtues of these three into one : By promoting the act of assimilation itself, as in seasonable sleep, some external application, &c.

The *renovation* of what begins to grow old, is performed two ways : By the inteneration of the habit of the body ; as in the use of emollients, emplaisters, unguents, &c. of such a nature, as do not extract but impress : Or by purging off the old juices, and substituting fresh ones ; as in seasonable evacuations, attenuating diets, &c.

The same author adds these three axioms : That the prolongation of life is to be expected, rather from some stated diets, than either from any ordinary regimen or any extraordinary medicines ; more from operating on the spirits, and mollifying the parts, than from the manner of feeding ; and this mollifying of the parts without is to be performed by substantials, imprints, and occultants. See *LONGEVITY*.

Vegetable LIFE. See *PLANTS*.

LIFE-RENT, in Scots law. When the use and enjoyment of a subject is given to a person during his life, it is said to belong to him in life-rent.

LIGAMENT, in its general sense, denotes any thing that ties or binds one part to another.

LIGAMENT, in anatomy, a strong compact substance, serving to join two bones together. See *ANATOMY*, n^o 7.

LIGARIUS (Quintus), a Roman consul in Africa, 49 B. C. Taking part with Pompey, he was forced by Julius Cæsar to return to Rome : to obtain his pardon, Cicero made that admired oration in his defence which has immortalized the memory of the client with that of his celebrated advocate.

LIGATURE, in surgery, is a cord, band, or string ; or the binding any part of the body with a cord, band, fillet, &c. whether of leather, linen, or any other matter.

Ligatures are used to extend or replace bones that are broken or dislocated ; to tie the patients down in lithotomy and amputations ; to tie upon the veins in phlebotomy, on the arteries in amputations, or in large wounds ; to secure the splints that are applied to fractures ; to tie up the processes of the peritoneum with the spermatic vessels in castration ; and, lastly, in taking off warts or other excrescences by ligature.

LIGATURE, is also used to signify a kind of bandage or fillet, tied round the neck, arm, leg, or other part of the bodies of men or beasts, to divert or drive off some disease, accident, &c.

LIGATURE is also used for a state of impotency, in respect to venery, pretended to be caused by some charm or witchcraft.

Kæmpfer tells of an uncommon kind of ligature or knotting, in use among the people of Massacar, Java, Malaja, Siam, &c. By this charm or spell, a man binds up a woman, and a woman a man, so as to put it out of their power to have to do with any other person ; the man being thereby rendered impotent to any other woman, and all other men impotent with respect to the woman.

Some of their philosophers pretend, that this ligature may be effected by the shutting of a lock, the drawing of a knot, or the sticking of a knife in the wall, at the point of time wherein the priest is joining a couple together ; and that a ligature, thus effected, may be dissolved, by the spouse's unringing through a ring. This piece of superstition is said to obtain also among the Christians of the East.

The same author tells us, that during the ceremony of marriage in Russia, he observed an old fellow lurking behind the church-door, and mumbling over a string of words ; and, at the same time, cutting a long rod, which he held under his arm, into pieces ; which, it seems, is a common practice at the marriages of great persons, and done with design to elude and counterwork any other person that might possibly be inducing the ligature.

The secret of inducing a ligature is delivered by the same author, as he was taught it on the spot by one of their adepts : but it is too absurd and obscene to deserve being transcribed here.

M. Marshal mentions a ridiculous form of ligature, which he received from a bramin at Indostan : " If (says he) the little worm in the wood *lucurara kara* be cut into two, and the one part flirs and the other not, if the stirring part be bruised, and given with half a beetle to a man, and the other half to a woman, the charm will keep each from ever having to do with any other person." Phil. Trans. N^o 268.

LIGATURE, in the Italian music, signifies a tying or binding together of notes. Hence syncope are often called *ligatures*, because they are made by the ligature of many notes. There is another sort of ligatures for breves, when there are many of these on different lines, or on different spaces, to be sung to one syllable.

LIGATURES, among printers, are types consisting of two letters or characters joined together ; as *æ*, *ß*, *ff*, *ß*, *fi*. The old editions of Greek authors are extremely full of ligatures ; the ligatures of Stephens are by much the most beautiful.—Some editions have been lately printed without any ligatures at all ; and there was a design to explode them quite out of printing. Had this succeeded, the finest ancient editions would in time have grown useless ; and the reading of old manuscripts would have been rendered almost impracticable to the learned themselves.

LIGHT, in the most common acceptation of the word, signifies that invisible ethereal matter which makes objects perceptible to our sense of seeing. Figuratively, it is also used for whatever conveys instruction to our minds, and likewise for that instruction itself.

The nature of light hath been a subject of speculation from the earliest ages of philosophy. Some of the first those first distinguished by the appellation of philosophers even doubted whether objects became visible by means of any thing proceeding from them, or from the eye of the spectator. The fallacy of this notion must very soon have been apparent, because, in that case, we ought to have seen as well in the night as in the day. The opinion was therefore qualified by Empedocles and Plato ; who maintained, that vision was occasioned by particles continually flying off from the surfaces of bodies, which met with others proceeding from.

Light.

from the eye; but Pythagoras ascribed it solely to the particles proceeding from the external objects and entering the pupil of the eye.

2
Of Des
Cartes.

Among the modern philosophers there have been two celebrated opinions, *viz.* the Cartesian and Newtonian. According to the former, light is an invisible fluid present at all times and in all places, but which requires to be set in motion by an ignited or otherwise properly qualified body in order to make objects visible to us.—The Newtonians maintain, that light is not a fluid *per se*, but consists of a vast number of exceedingly small particles shaken off in all directions from the luminous body with inconceivable velocity by a repulsive power; and which most probably never return again to the body from which they were emitted. These particles are also said to be emitted in right lines by the body from whence they proceed: and this rectilinear direction they preserve until they are turned out of their original path by the attraction of some other body near which they pass, and which is called *inflection*; by passing through a medium of different density, which is called *refraction*, or by being thrown obliquely or directly forward by some body which opposes their passage, and which is called *reflection*; or, lastly, till they are totally stopped by the substance of any body into which they penetrate, and which is called their *extinction*. A succession of these particles following one another in an exactly straight line is called a *ray of light*; and this ray, in whatever manner it hath its direction changed, whether by refraction, reflection, or inflection, always preserves its rectilinear course; neither is it possible by any art whatever to make it pass on in the segment of a circle, ellipsis, or other curve.—From some observations on the eclipses of Jupiter's satellites, and also on the aberration of the fixed stars, it appears that the particles of light move at the rate of little less than 200,000 miles in a second of time. See *ASTRONOMY-Index*.

4
Objections
to the New-
tonian doc-
trine.

To this doctrine concerning the nature of light several objections have been made; the most considerable of which is, That in this case, as rays of light are continually passing in different directions from every visible point, they must necessarily interfere with and destroy each other in such a manner as entirely to confound all distinct perception of objects, if not to destroy the sense of seeing altogether; not to mention the continual waste of substance which a constant emission of particles must occasion in the luminous body, and which since the creation ought to have greatly diminished the sun and stars, as well as increased the bulk of the earth and planets by the vast quantity of particles of light absorbed by them in such a long period of time.

5
Answer by
Mr Mel-
ville.

In answer to this objection, Mr Melville gives some ingenious illustrations concerning the extreme subtilty of light, or the smallness of the particles of which it consists, and of which few persons, even of those who admit the hypothesis, have any idea. He observes, that there is probably no physical point in the visible horizon that does not send rays to every other point, unless where opaque bodies interpose. Light, in its passage from one system to another, often passes thro' torrents of light issuing from other suns and systems, without ever interfering or being diverted in its course, either by it, or by the particles of that elastic medium

which some phenomena give us reason to suppose are diffused through all the mundane space. To conclude, that the particles of which light consists must be incomparably rare, even when they are the most dense; that is, that the semidiameters of the two nearest particles, in the same or in different beams, soon after their emission, are incomparably less than their distance from one another. This difficulty concerning the non-interference of the particles of light is not solved, as he observes, by supposing with Mr Boscovich and others, that each particle is endued with an insuperable impulsive force; because, in that case, their spheres of impulsion would even be more liable to interfere, and they would on that account be more likely to disturb one another.

The difficulty, according to Mr Canton, will nearly vanish, if a very small portion of time be allowed between the emission of every particle and the next that follows in the same direction. Suppose, for instance, that one lucid point of the sun's surface emits 150 particles in a second, which are more than sufficient to give continual light to the eye without the least appearance of intermission; yet still the particles of which it consists, will on account of their great velocity be more than 1000 miles behind each other, and thereby leave room enough for others to pass in all directions.

In order to determine whether light really consists of particles emitted from the luminous body, or only in the vibrations of a subtle fluid, it has been attempted to find out its momentum, or the force with which it moves. The first who set about this matter with any tolerable pretensions to accuracy was M. Mairan. Others indeed, particularly Hartsoeker and Homburg, had pretended, that in certain cases this momentum was very perceptible; but M. Mairan proved, that the effects mentioned by them were owing to currents of heated air produced by the burning-glasses used in their experiments, or to some other causes overlooked by these philosophers. To decide the matter therefore, if possible, he began with trying the effects of rays collected by lenses of four and six inches diameter, and thrown upon the needle of a compass; but the result was nothing more than some tremulous motion from whence he could draw no conclusion. After this, he and Mr du Fay constructed a kind of mill of copper, which moved with an exceeding slight impulse; but though they threw upon it the focus of a lens of seven or eight inches diameter, they were still unable to draw any conclusions from the result.

M. Mairan afterwards procured a horizontal wheel of iron three inches in diameter, having fix radii, at the extremity of each of which was a small wing fixed obliquely. The axis of the wheel, which was also of iron, was suspended by a magnet. The wheel and the axis together did not weigh more than 30 grains; but though a motion was given to this wheel when the focus of the burning glass was thrown upon the extremities of the radii, yet it was so irregular, that he could not but conclude that it was occasioned by the motion of the heated air. He then intended to have made his experiment *in vacuo*, but he concluded that it was unnecessary. For, besides the difficulty of making a vacuum, he was persuaded that there was in our atmo-

Light.

6
By Mr Canton.

7
Experiments
to determine
the momen-
tum of, light.

8
By Mr
Mairan.

Light.

Light.

9
By Mr
Michell.

sphere a thinner medium which freely penetrates even glass itself, the existence of which he imagined that he had sufficiently proved in his treatise on the aurora borealis. See *AURORA BOREALIS*, n. 5.

Mr Michell some years ago endeavoured to ascertain the momentum of light in a manner still more accurate. The instrument he made use of for this purpose consisted of a very thin plate of copper, a little more than an inch square, which was fastened to one end of a slender harpichord-wire about ten inches long. To the middle of this was fixed an agate cap, such as is commonly used for small mariner's compasses, after the manner of which it was intended to turn; and at the other end of the wire was a middling sized shot-corn, as a counterpoise to the copperplate. The instrument had also fixed to it in the middle, at right angles to the length of the wire, and in an horizontal direction, a small bit of a very slender sewing-needle, about one-third or perhaps half an inch long, which was made magnetical. In this state the whole instrument might weigh about 10 grains. It was placed on a very sharp-pointed needle, on which the agate cap turned extremely freely; and to prevent its being disturbed by any motion of the air, it was included in a box, the lid and front of which were of glass. This box was about 12 inches long, six or seven inches deep, and about as much in width; the needle standing upright in the middle. At the time of making the experiment, the box was placed in such a manner that a line drawn from the sun passed at right angles to the length of it; and the instrument was brought to range in the same direction with the box, by means of the magnetical bit of needle above mentioned, and a magnet properly placed on the outside, which would retain it, though with extremely little force, in any situation. The rays of the sun were now thrown upon the copperplate above mentioned from a concave mirror of about two feet diameter, which, passing through the front-glass of the box, were collected into the focus of the mirror upon the copperplate. In consequence of this the plate began to move, with a slow motion of about an inch in a second of time, till it had moved through a space of about two inches and a half, when it struck against the back of the box. The mirror being removed, the instrument returned to its former situation by means of the little needle and magnet; and the rays of the sun being then again thrown upon it, it again began to move, and struck against the back of the box as before; and this was repeated three or four times with the same success.—The instrument was then placed the contrary way in the box to that in which it had been placed before, so that the end to which the copperplate was affixed, and which had lain, in the former experiment, towards the right hand, now lay towards the left; and the rays of the sun being again thrown upon it, it began to move with a slow motion, and struck against the back of the box as before; and this was repeated once or twice with the same success. But by this time the copperplate began to be so much altered in its form, by the extreme heat which it underwent in each experiment, and which brought it nearly into a state of fusion, that it became very much bent, and the more so as it had been unwarily supported by the middle, half of it lying above and half below the wire to which it was fastened. By this means it now varied

so much from the vertical position, that it began to act in the same manner as the sail of a windmill, being impelled by the stream of heated air which moved upwards, with a force sufficient to drive it in opposition to the impulse of the rays of light.

“If we impute (says Dr Priestley) the motion produced in the above experiment to the impulse of the rays of light, and suppose that the instrument weighed ten grains, and acquired a velocity of one inch in a second, we shall find that the quantity of matter contained in the rays falling upon the instrument in that time amounted to no more than one twelve-hundredth-millionth part of a grain, the velocity of light exceeding the velocity of one inch in a second in the proportion of about 12,000,000,000 to 1. Now the light in the above experiment was collected from a surface of about three square feet, which reflecting only about half what falls upon it, the quantity of matter contained in the rays of the sun incident upon a square foot and an half of surface in one second of time, ought to be no more than the twelve-hundred-millionth part of a grain, or, upon one square foot only, the eighteen-hundred-millionth part of a grain. But the density of the rays of light at the surface of the sun is greater than at the earth in the proportion of 45,000 to 1: there ought, therefore, to issue from one square foot of the sun's surface in one second of time, in order to supply the waste by light, one forty-thousandth part of a grain of matter; that is, a little more than two grains in a day, or about 4,752,000 grains, or 670 pounds avoirdupois nearly, in 6000 years; a quantity which would have shortened the sun's semidiameter no more than about ten feet, if it was formed of the density of water only.”

The Newtonians, besides the answer just now given to the most formidable objections of their opponents, have endeavoured to prove the impossibility of light being a vibration in any fluid. Sir Isaac, in his *Principia*, demonstrates, that no rectilinear motion can be propagated among the particles of any fluid unless these particles lie in right lines; and he hath also shown, that all motion propagated through a fluid diverges from a rectilinear progress into the unmoved spaces. Hence he concludes, “a pressure on a fluid medium (i. e. a motion propagated by such a medium beyond any obstacle, which impedes any part of its motion), cannot be propagated in right lines, but will be always infecting and diffusing itself every way, to the quiescent medium beyond that obstacle. The power of gravity tends downwards; but the pressure of water rising from it tends every way with an equable force, and is propagated with equal ease, and equal strength, in curves, as in straight lines. Waves, on the surface of the water, gliding by the extremes of any very large obstacle, infect and dilate themselves, still diffusing gradually, into the quiescent water beyond that obstacle. The waves, pulses, or vibrations of the air, wherein sound consists, are manifestly infected, though not so considerably as the waves of water; and sounds are propagated with equal ease, through crooked tubes and through straight lines; but light was never known to move in any curve, nor to infect itself *ad umbram*.”

To this Mr Rowning adds another proof. “The Cartesian notion of light (says he), was not that it is propagated from luminous bodies by the emission of small

II
Objections
against the
Cartesian
opinion by
Sir Isaac
Newton.

73

By Mr
Rowning.

small

Light.

small particles, but that it was communicated to the organ of sight by their pressure upon the *materia subtilis*, with which they supposed the universe to be full. But, according to this hypothesis, it could never be dark; because, when a fluid sustains any pressure, if that fluid fills all the space it takes up, absolutely, without leaving any pores, which is the case of the supposed *materia subtilis*, then that pressure must necessarily be communicated *equally and instantaneously* to every part. And therefore, whether the sun were above or below the horizon, the pressure communicated, and consequently the light, would be the same. And farther, as the pressure would be instantaneous, so would the light, which is contrary to what is collected from the eclipses of Jupiter's satellites."

It is obvious, however, that whatever side we take concerning the nature of light, many, indeed almost all the circumstances concerning it, are incomprehensible, and beyond the reach of human understanding.

Most of the discous flowers, by some power unknown to us, follow the sun in his course. They attend him to his evening retreat, and meet his rising lustre in the morning with the same unerring law. If a plant also is shut up in a dark room, and a small hole is afterwards opened by which the light of the sun may enter, the plant will turn towards that hole, and even alter its own shape in order to get near it; so that though it was straight before, it will in time become crooked, that it may get near the light. It is not the *heat*, but the *light* of the sun, which it thus covets; for, though a fire be kept in the room, capable of giving a much stronger heat than the sun, the plant will turn away from the fire in order to enjoy the sun's light.—The green colour of plants also depends on the sun's light being allowed to shine upon them; for without this they are always white.—From this last circumstance, and likewise the property which the solar light has of blackening precipitates of silver from the nitrous acid*, it has been thought that light either contains the *phlogiston* in very considerable quantity, or is itself a modification of that unknown substance. But that this cannot be the case, we have now a proof little short of demonstration, from the last experiments of Dr Priestley concerning the production of pure dephlogisticated air from pump-water, by means of the solar light †. If light either were the *phlogiston* itself, or contained it in very considerable quantity, it is impossible the air produced by its means could be pure and dephlogisticated.—For the properties of light acting as the medium of our perceptions by the sense of sight, see the article *OPTICS*.

In the Philosophical Transactions for 1776, Dr Fordyce gives an account of some experiments upon the light produced by Inflammation. They were made to determine, whether there was any light produced by the inflammation itself, independent of ignition. Substances, he observes, begin to be luminous in the dark when heated to between 6 and 700 degrees of Fahrenheit's thermometer. If the substances be colourless, they first emit a red light; then a red mixed with yellow; and lastly, with a great degree of heat, a pure white. This whiteness, however, seems to depend greatly upon the density of the body; for the vapour at the end of the flame urged by a blow-pipe is not visibly luminous, though its heat be sufficiently great to

give a white heat to glass. The colour of the ignited matter, according to our author, has an effect upon the colour of the light emitted. Thus, during the calcination of zinc, the calx of which is white, a light is produced farce inferior in beauty to that of the sun himself. A beautiful green is communicated by its green calx of copper to the flame of a fire into which it is thrown; and the yellow empyreumatic oil into which tallow or any common oil is converted in burning, communicates a part of its own colour to the flame, which very much alters the appearance of bodies seen by candle-light from what it is by day-light. It does not, however, appear that this always holds good; for the flame of burning iron is intensely white; and yet neither the metal itself nor any of its calces are of that colour.

Light produced by the decomposition of bodies by inflammation without ignition is always blue, and produces very little heat. Thus phosphorus of urine is decomposed by mere exposure to the air, and gives but very little heat, though a considerable light is emitted. The following proof is adduced by our author that this emission of light is a true inflammation. "Take a receiver of white glass, capable of holding six or eight gallons; put into it a drachm of phosphorus finely powdered, and half an ounce of water; cork the mouth of the receiver, and tie it over with a bladder, so as to exclude the external air: incline the receiver to all sides gently, and afterwards set it to rest; the powder will adhere to the sides, and the water will drain from it. As soon as the water is sufficiently drained off, the particles of the phosphorus will become luminous, and emit a thick smoke: this will continue for some days; but at last no more light or vapour will appear. Open the receiver, and you will find that the air will have contracted, as it does from the inflammation of a candle in Van Helmont's experiment; that is, about a twentieth part. It is become unfit for inflammation; for if a lighted candle be immersed in it, it will be extinguished as well as the phosphorus, and an animal will be suffocated by it. The air then has suffered the same change as that which has served for the inflammation of other bodies; and the phosphorus is partly decomposed, the water in the receiver being impregnated with its acid, and the air saturated with its *phlogiston*. Blow fresh air into the receiver, and the light and smoke will immediately re-appear. In like manner it is known that sulphur will burn and give light without heat sufficient for ignition. Take a piece of iron heated nearly red hot, and throw a little gun-powder upon it. If the heat be of a proper degree, the sulphur will burn off with a blue flame, without heat sufficient for ignition; for if such heat had been produced, the gun-powder would certainly have taken fire. It is the inflammation and decomposition of the sulphur, and not its evaporation, which produces the light; for if we sublime sulphur in vessels of the most transparent glass, no light will be visible except at the very beginning, when a small portion of it burns till the air in the vessel be saturated, and rendered unfit for inflammation."

Our author is of opinion, that the light produced by inflammation is of a blue colour, from whatever body it is derived. This he endeavours to prove from an observation on the flame of a candle, the lower part of which, where the inflammation is, always appears of a blue

Light.

16

Colour of the ignited matter supposed to have an influence in the colour of the flame.

17

Light produced in some cases with very little heat.

13
Inaccessible properties of light.

* See Chemistry, n° 756.

14
Is not a modification of the *phlogiston*.

† See Aerology, n° 36, et seq.

15
Dr Fordyce's experiments on the light produced by inflammation.

18

Light from inflammation is of a blue colour, from whatever body it is derived. This he endeavours to prove from an observation on the flame of a candle, the lower part of which, where the inflammation is, always appears of a blue

Light. a blue colour. "Or (says he) take a candle which has been burned for some time; extinguish it by applying tallow to the wick, and let it stand to cool; afterwards set it on fire by the flame of another candle; at first no more vapour will arise than can be acted upon by the air at once; inflammation, therefore, will go on in the whole small flame, and it will be blue. When a candle burns, the following process takes place. The tallow boils in the wick; and is converted into empyreumatic oil, rising from it in the form of vapour. As it rises from every part of the wick, the volume is increased till it comes to the top, and gives to the lower part of the flame the form of the frustum of an inverted cone. The air is applied to the outer surface of the column of vapour; and there decomposing the empyreumatic oil, produces heat and blue light: the stratum of vapour, within the outer burning surface, is heated white-hot; the heat diminishes towards the centre, which, if the flame be large, is scarcely red-hot; as the column rises, decomposition taking place constantly on its surface, it necessarily diminishes, and the upper part of the flame is conical. That the tallow boils in the wick, can be seen: that it is converted into empyreumatic oil, is proved by drawing the vapour, rising in the middle of the flame, where it does not burn, into a glass-tube: the empyreumatic oil condenses; this also shows that the flame does not burn in the middle. That the heat is produced on the outer surface, appears, if we take a small rod of glass, and put the end of it in the blue flame on the surface; it will be heated white-hot, and melt. Immerse the rod into the flame, so that the point shall be in the centre: it will melt and bend where it is in the blue flame on the surface; whereas, if the flame be large, the point which is in the centre will hardly be heated red-hot. That the empyreumatic oil is decomposed, is proved by burning a candle with a very small wick in distilling vessels; no condensation of empyreumatic oil takes place."

20 Mr Morgan's observations upon light.

In the 75th volume of the Transactions, Mr Morgan treats the subject of light at some length. As a foundation for his reasoning he assumes the following data. 1. That light is a body, and, like all others, subject to the laws of attraction. 2. That light is a heterogeneous body; and that the same attractive power operates with different degrees of force on its different parts. 3. That the light which escapes from combustible when decomposed by heat, or by any other means, was, previous to its escape, a component part of these substances. Hence he concludes, that when the attractive force by which the several rays of light are attached to a body is weakened, some of those rays will escape sooner than others; it being evident that those which are detained by the smallest power will soonest go off when the general attractive force is weakened. This he illustrates by the example of a mixture of spirit of wine, water, and other more fixed substances. The application of a gentle heat will carry off the spirit of wine only; a heat not much greater will evaporate the spirits and water mixed together; and a still greater degree will carry off a mixture of all the particles together. "In like manner (says he), when the surface of a combustible is in a state of decomposition, those parts of it which are the least fixed, or which are united with the least force, will be separated first. Amongst these the indigo rays of light will make the earliest appearance."

Vol. X. Part I.

By increasing the heat, we shall mix the violet with the indigo: by increasing it still more, we shall add the blue and the green to the mixture, till at length we reach that intensity of heat which will cause all the rays to escape at the same instant, and make the flame of a combustible perfectly white. By examining the flame of a common candle, we may observe, that its lowest extremities, or the part in which the black colour of the wick terminates, discharges the least heat; and that, as the vertex of the flame is approached, a successive order of parts is passed through, in which the lowest is continually adding to the heat of that which is just above it, till we come to the top of the flame, near which all the heat is collected into a focus. At the lowest extremity, however, where the heat is inconceivable, a blue colour may always be observed; and from this appearance, amongst others, I think it may be concluded, that the blue rays are some of those which escape from combustibles in an early period of their decomposition; and that if the decomposition could be examined in a period still more early, the colour of the flame would be violet. By an *à priori* deduction of this kind, I was led to observe, that to the external boundary of the flame of a common candle is annexed a filament of light; which if proper care be taken to prevent the escape of too much smoke, will appear most beautifully coloured with the violet and indigo rays. If sulphur or ether be burned, or any other combustible whose vapour is kindled in a small degree of heat, a blue flame will appear; which, if examined by the prism, will be found to consist of the violet, the indigo, the blue, and sometimes a small quantity of the green rays. The best mode, however, of showing the escape of some rays by that degree of heat which will not separate others till increased, is the following. Give a piece of brown paper a spherical form, by pressing it upon any hard globular substance. Gradually bring the paper thus formed to that distance from the candle at which it will begin to take fire. In this case a beautiful blue flame may be seen hanging, as it were, by the paper till a hole is made in it; when the flame, owing to the increased action of the air upon all parts of it, becomes white, though the edges still continue of a blue or violet colour. As a confirmation of this, it may be observed, that the very flame, which when exposed to a certain degree of heat emits only the most refrangible rays, will, if exposed to one considerably greater, emit also those which are less so. The flames of sulphur and spirit of wine, if suddenly exposed to the heat of a reverberatory, will change their blue colour for one that is perfectly white."

To obtain a more perfect knowledge of this matter, our author examined the light proceeding from combustible bodies by Mr Melville's method. Having darkened the room, he interposed betwixt the eye and combustible a sheet of pasteboard, in which was a very small hole for transmitting the light. Viewing the light which passed through this hole with a prism, he observed, that the blue and violet rays were in greater abundance than any of the rest, though all the different kinds passed through it when spirit of wine only was made use of. When the combustion of the spirit of wine was checked by throwing in sal ammoniac, the red rays disappeared, but made their appearance again as soon as the salt became heated to such a degree as to

Light. **27** Remarks on the flame of a candle.

22 Curious experiment with a piece of brown paper.

23 Experiments on light by Mr Melville's method.

F increase

Light.

increase rather than diminish the combustion of the spirits. On examining the different parts of the flame separately, it was always found that the colours varied according to the degree of heat. At the base of the flame, or where the heat was least, the indigo, violet, and blue always appeared in greatest quantity; but as the vertex was approached, the other rays appeared, and at the very top they were all visible through a prism.

24
Conclusions
from these
experi-
ments.

From these facts Mr Morgan concludes, 1. That light, as an heterogeneous body, is gradually decomposed during combustion; that the indigo rays escape with the least heat, and the red with the greatest; and from this again he explains the reason why flames assume different colours. "If a piece of paper (says he), impregnated with a solution of copper in nitrous acid, be set on fire, the bottom and sides of the flame are always tinged green. Now this flame is evidently in that weak state of decomposition in which the most refrangible rays escape in the greatest abundance; but of these the green rays escape most plentifully through the unignited vapour and that portion of the atmosphere which is interposed betwixt the eye and the flame. This peculiarity may be observed in greatest perfection in brass foundries. Here the heat, though very strong, is scarcely sufficient to decompose the metallic vapour which escapes from the melted brass; whence the flame has a very singular appearance, the edges being green, and the body of such an appearance, as to give substances viewed by it a pallid and ghastly appearance, owing to the want of a sufficient quantity of red rays to make a perfect white."

25
Red ap-
pearance of
bodies in
their last
state of ig-
nition ex-
plained.

2. Mr Morgan explains the red appearance of bodies in their last state of ignition, from the previous escape of the more refrangible rays, so that only the red ones remain. "Again, (says he), we may consider the external surface of the combustible body as annexed to an inner surface, which may be partly, but not so perfectly decomposed as itself: for the violence of the heat will be found to lessen in its effects the nearer it approaches to the centre of the substance which is exposed to it. Hence we are to consider the parts which are just covered by the external surface as having lost less of their component light than the external surface itself; or the former may retain the green rays when the latter has lost both indigo, violet, blue, and green.

3. "Those parts which are nearer the centre of the body than any of the preceding, must, as they are farther from the greatest violence of the heat, have lost proportionably fewer of their rays; or while the external parts may have lost all but the red, these may have lost only the indigo and violet.

4. "The most central parts may be unaffected by the heat; and whenever the fire does reach these parts, they will immediately discharge their indigo rays, and be decomposed in the gradual manner already mentioned. A piece of rotten wood, while burning, will exemplify and confirm the preceding illustration. When influenced by the external air only, if examined through a prism, no rays will be found to escape but the orange and the red. By blowing upon the burning wood with a pair of bellows, the combustion being increased, will affect those internal parts of the body which were not acted upon before. These parts therefore will begin to lose their light, and a prism will show the green, blue, violet, and indigo, all appearing in succession. Ap-

pearances similar to the preceding may be observed in a common kitchen fire. When it is faintest, its colour is most red, the other rays having been emitted, and the combustion at a stand; but by blowing upon it in this state, its brightness will be increased, and more and more of the rays which are yielded by the internal parts of the body will come to the eye, till at length, by continuing to blow, the combustion will be made so complete as to yield all the rays, or to make it appear perfectly white."

Our author concludes the subject with a criticism upon Sir Isaac Newton's definition of flame, viz. Newton's definition of flame is an instance of combustion whose colour will be determined by the degree of decomposition which takes place. When very imperfect, only the most refrangible rays will appear. If it be very perfect, all the rays will appear, and its flame will be brilliant in proportion. But there are flames which consist of burning particles, the rays of which have partly escaped before they ascended in form of vapour. "Such (says he) would be the flame of a red hot coal, if exposed to such a heat as would gradually convert it into vapour. When the fire is very low under the furnace of an iron foundry, at the upper orifice of the chimney a red flame of this kind may be seen, which is different from the flame that appears immediately after fresh coals have been thrown upon the fire; for in consequence of adding such a supply to the burning fuel, a vast column of smoke ascends, and forms a medium so thick as to absorb most of the rays excepting the red."

Thus we have a most elaborate theory for the solving of phenomena which seem not easily to admit of any solution. It is obvious, however, that the theory upon which he builds his system are altogether unfounded and hypothetical. That light is subject to the laws of attraction, cannot be proved unless we could examine it independent of any other substance whatever; that is to say, in a perfect vacuum; and even in the most perfect vacuum that can be formed, we are far from being certain that no other matter is present. Light is inflected and turned out of its course in many different ways when acting in the common atmosphere, but we have no reason to suppose that it would be the same in a perfect vacuum; at least we have not a right to lay it down as a principle to argue from, unless it were verified by experience. Even the heterogeneous nature of light seems far from being absolutely established. The refraction into different colours by the prism seems insufficient to do so; for though, by a quick revolution of these colours when painted upon any substance, we may produce a kind of white colour, it is by no means perfect, but looks as if some black had got amongst it. The opinion of those who maintain that the prismatic colours are no other than different mixtures of light and shade, seems therefore equally probable with the other. His third position, that the light emitted by combustible bodies formed part of their substance before combustion, seems still worse founded; for instead of being fixed in solid substances, all the light and heat proceeding from combustion seem entirely to come from the air. By means of heat originally applied, the substance, or part of it, is raised into vapour; and this vapour, we have every reason to suppose, consists of elementary fire united with the solid substance. It is this fire, heat, or light, which

26

Sir Isaac
Newton's
definition
of flame
is criticised by
Mr Mor-
gan.

27

Mr Mor-
gan's theo-
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ed.

^{Light} is afterwards thrown out from the vapour in combustion; and new supplies of it perpetually come from the atmosphere, as is abundantly shown under the articles COMBUSTION, FIRE, FLAME, and many others throughout this work. We cannot therefore think it either inconsistent, or very improbable, that in the beginning of combustion, when the *subtile* light is clouded with a great quantity of vapour, it should appear of a blue or violet colour; and that in proportion as this vapour is dissipated, it should appear green, yellow, red, or perfectly white: for it is observable, that in dephlogisticated air, even those flames which in the common atmosphere always appear blue, such as sulphur and spirit of wine, are then changed to a dazzling white. The pure light of the sun also seen through smoke, or even through a great quantity of aqueous vapour, appears red; and there is not the least doubt, that if we were to view the sun while he thus appears red through any blue medium, he would appear purple; and in like manner, were we to view a blue flame through a yellow medium, it would appear of a green colour.

²⁸
His observations on electric light.

In the fame paper Mr Morgan has some curious observations upon the electric light. There is neither fluid nor solid, he says, through which the electric fluid in its passage will not appear luminous, if we do not make the quantity, through which it has to pass, too great. In his experiments on fluids, he puts them into a tube about three quarters of an inch diameter and four inches long. The orifices are then stopped up with two corks, through which two pointed wires are thrust, so that the points may approach within one eighth part of an inch of each other; and in this case the electric matter which passes through the fluid is always luminous, provided a sufficient force be used. The experiment, however, is dangerous, unless great care be taken; and the tube, unless it be very strong, will be broken by a very slight discharge. With acids the experiment succeeds more difficultly; they must be put into capillary tubes, and the wires placed very near to each other. A strip of gold leaf one eighth of an inch diameter, and a yard long, becomes quite luminous by discharging a battery over it; and our author cannot ascertain the length to which it might be made luminous. The experiment will also succeed with Dutch metal or silver leaf. If the gold or silver leaf be put upon a glass, and that laid in water, the whole will appear most beautifully luminous on discharging a battery through it.

The better a conductor that any substance is, the greater is the difficulty of making the electric spark visible in it. Hence it requires a much greater power of electricity to make a spark visible in boiling than in cold water; the former being a much better conductor than the latter. In like manner, the mineral acids are much better conductors than common water; and, of consequence, the spark is made to appear in them with much more difficulty than in water. This appears from what has been already mentioned; and our author likewise observes, that if a few drops of acid be poured into the tube containing the water employed for this purpose, it will scarcely be possible to make the spark luminous in it by any force.

The rarity of any body greatly increases the ease with which the electric spark is made visible in it; as

^{Light} appears from discharging a vial through rarefied air, the vapour of ether, spirit of wine, or water.

In the prosecution of his experiments upon this subject, our author cemented a ball of iron into the orifice of a tube 48 inches long, and two thirds of an inch diameter, so that it could bear the weight of the quicksilver with which the tube was filled all to a small space at the open end, which contained a few drops of water. Having inverted the tube, and plunged the open end of it into a basin of mercury, that in the tube stood nearly half an inch lower than in a barometer with which it was compared at the same time, owing to the vapour which was formed by the water; but the spark passed as brilliant through the rarefied water as it does through rarefied air. If spirit of wine be employed instead of water in this experiment, the spark will not be so luminous. In the vapour of ether a great force is requisite to make the spark luminous, but good ether will press the mercury down as far as 16 or 17 inches. By rarefying the vapour, however, the spark will pass through it with more ease.

On examining the mineral acids *in vacuo*, Mr Morgan could not find that any vapour escaped from them. To give them the requisite degree of tenuity, therefore, he traced a line upon glass about an eighth part of an inch broad, with a camel's hair pencil dipped in the acids: the line extended sometimes to the length of 27 inches; in which case, the electric spark would pass over the whole with great brilliancy. If by widening the line, however, or putting on a drop of acid in any particular part, the quantity was increased, the spark never appeared in that part.

The brightness of the electric light is always in proportion to its condensation. Thus, if a spark taken from a powerful electrical machine divides itself into brushes, or throws out sparks from the sides, by which the light is diffused over a larger surface, it thus becomes less brilliant; and in all cases in which any diffusion of light, whether electric or not, takes place, the case will be the same.

In some cases, Mr Morgan is of opinion, that, even with the electric fluid, only the more refrangible rays of light make their escape. Thus, the electrical brush is always of a purplish or bluish colour; and if you convey a spark through a Torricellian vacuum not very perfectly made, it will be of an indigo colour. This, however, does not seem to arise from any other cause than the mere weakness of the light, which, in passing through the vapours of the atmosphere, or perhaps through the humours of the eye itself, affects our organs of sight in that manner.

Our author next proceeds to examine the influence of media upon electric light; which, he says, is similar media upon their influence upon solar light, and serves to explain several phenomena.

“Let a pointed wire (says he), having a metallic ball fixed to one of its extremities, be forced obliquely into a piece of wood, so as to make a small angle with its surface; and to make the point lie about one eighth of an inch below it. Let another pointed wire, which communicates with the ground, be forced in the same manner into the same wood, so that its point may in like manner be about one eighth of an inch below the surface, and about two inches distant from the point

²⁹
Of the brightness of electric light.

³⁰
Sometimes of electric rays only escape from the electric fluid.

³¹
Influence of media upon electric light.

Light.

32
Curious experiment of sending the electric spark thro' wood.

of the first wire. Let the wood be insulated, and a strong spark, which strikes on the metallic ball, will force its way through the interval of wood which lies between the points, and appear as red as blood. To prove that this appearance depends on the wood's absorption of all the rays but the red, I would observe, that the greater the depth of the points is below the surface, the less mixed are the rays. When they are deeper below the surface, only the red come to the eye through a prism; when raised a little nearer the surface, the red and orange appeared; when nearer still, the yellow; and so on, till, by making the spark pass through the wood very near its surface, all the rays were at length able to reach the eye. If the points be only one eighth of an inch below the surface of soft deal wood, the red, the orange, and the yellow rays will appear as the spark passes through it. But when the points are at an equal depth in a piece of harder wood, box for instance, the yellow, and perhaps the orange, will disappear. As a farther proof of this absorption of the rays, it may be observed, when the spark strikes very bright upon one side of the piece of deal, it will appear quite red on the other. In like manner, a red appearance may be given to a spark which strikes bright over the inside of a tube, merely by spreading some pitch very thinly over the outside of the same tube."

33
Different appearance of the electric spark at different distances.

Mr Morgan now proceeds to mention some experiments which seem to militate against the doctrine he has been endeavouring to establish, rather than to support it; viz. 1. If into a Torricellian vacuum of any length a few drops of ether are conveyed, and both ends of the vacuum stopped up with metallic conductors, so that a spark may pass through it, the spark in its passage will make the following appearances. When the eye is placed close to the tube, the spark will appear perfectly white; if the eye is removed to the distance of two yards, it will appear green; but at the distance of six or seven yards, it will appear reddish. "These changes evidently depend (says our author) on the quantity of medium through which the light passes; and the red light more particularly, which we see at the greatest distance from the tube, is accounted for on the same principle as the red light of the beclouded sun, or a lighted candle."

2. Dr Priestley long ago observed the red appearance of the electric spark, when passing through inflammable air. But this appearance is very much diversified according to the quantity of medium through which the spark is beheld. At a very considerable distance the red comes unmixed to the eye; but if the eye be placed close to the tube, the spark appears white and brilliant. By increasing, however, the quantity of fluid conveyed through any portion of inflammable air, or by condensing that air, the spark may be made perfectly white. It may further be observed, that all weak explosions and sparks, when viewed at a distance, make a reddish appearance. The reason of these appearances seems to be, that the weaker the spark or explosion is, the more it is disposed to assume a red colour when viewed at a distance. This seems to confirm what has already been mentioned as a probable hypothesis, that the different colours of light are entirely owing to the medium through which they are viewed.

Light.

33
Observations on phosphoric light.
* See Phosphorus.

On phosphoric light Mr Morgan makes some curious observations; but still argues on the same principles we have already mentioned. "Some shells (says he), prepared according to Mr Wilson's directions", after being exposed to the sun, or to the fash of a battery, emit a purple, others a green, and others a reddish light. If, with Mr Wilson, we suppose that these shells are in a state of slow combustion, may we not conclude that some are just beginning to burn, and therefore emitting the most refrangible rays; while others are in a more advanced state of combustion, and therefore emitting the least refrangible? If this conclusion be right, the shells which are emitting the purple or the green, must still retain the yellow, the orange, and the red, which will also make their appearance as soon as the combustion is sufficiently increased." In confirmation of this, Mr Morgan adduces the following experiment, viz. that if a shell, while emitting its green rays, be placed upon a warm shovel, the colour will soon be changed into a yellow mixed with red.—To the theory of slow combustion Mr Morgan makes the following objections.

1. If phosphoric shells owe their light to this cause, we must consider the word combustion, when applied to them, as implying all those circumstances which usually attend a body when on fire. On this supposition there ought to be an increase of the heat as well as of the decomposition of the combustible. But neither of these are found to take place in fact; for a phosphoric body never fails to lose its light entirely in a certain degree of heat, without losing the power of becoming phosphoric again when it has been sufficiently cooled. While very hot, the charge of the strongest battery conveyed over it has no effect.

2. When bodies are wasted by combustion, they can never be made to reassume the appearances which they previously displayed. "No power (says our author) can give to ashes the phenomena of a burning coal. But phosphoric bodies are very different in this respect; for a phosphoric shell may be made to lose all its light by exposure to heat, and again may be made as luminous as ever by exposure to the sun."

3. It is remarkable that some bodies which are most beautifully phosphoric, are at the same time the most obstinate in resisting fire. "Let us now see (says Mr Morgan) the consequence of admitting the common hypothesis, that the detention of those rays which fall upon phosphori is owing to some force which prevents their immediate reflection, but is not adequate to their entire absorption. This force, whatever it be, cannot well be supposed to operate with equal power on all these rays. If this be not the case, we cannot well avoid concluding, that phosphoric shells will assume different colours, owing to the earlier and later escape of the different rays of light. This conclusion is justified by an experiment already mentioned; viz. that when the force is such as to admit the escape of the purple, blue, and green, we have only to lessen that force, by warming the body, and the yellow, the orange, and red escape. Beccaria has proved, that there is scarcely any body which is not phosphoric, or may not become so by heat. But as the phosphoric force is most powerful when the purple rays only escape, so we are to conclude, that it is weakest when it is able to retain the red rays only. This is agreeable to several facts.

Light.

Chalk, oyster-shells, together with those phosphoric bodies whose goodness has been very much impaired by long keeping, when finely powdered, and placed within the circuit of an electrical battery, will exhibit, by their scattered particles, a shower of light; but these particles will appear reddish, or their phosphoric power will be sufficient only to detain the yellow, orange, and red rays. When spirit of wine is in a similar manner brought within the circuit of a battery, a similar effect may be discovered: its particles diverge in several directions, displaying a most beautiful golden appearance. The metallic calces are rendered phosphoric with the greatest difficulty; but even these may be scattered into a shower of red luminous particles by the electric stroke."

In a postscript to this paper, by Dr Price, it is observed, that by *phosphoric force*, Mr Morgan seems to mean, not the force with which a phosphoric body emits, but that with which it *absorbs and retains*, the light. This last force is proportioned to the degree of attraction between the phosphoric body and light; and therefore must, according to Mr Morgan's theory, be weakest when it so freely emits the light it has imbibed as not to retain those rays which adhere to it most strongly. According to Mr Morgan's theory, there are the rays which are the least refrangible. "It is, however (says Dr Price), an objection to it, that the less refrangibility of rays seems to imply a less force of attraction between them and the substances which refract them; but it should be considered, that, possibly, the force of cohesion, which unites the rays of light to bodies, may be a different power from that which refracts them."

Light independent of Heat. In general, a very considerable degree of heat is requisite to the emission of light from any body; but there are several exceptions to this, especially in light proceeding from putrescent substances and phosphorus, together with that of luminous animals, and other similar appearances. Light proceeding from putrescent animal and vegetable substances, as well as from glow-worms, is mentioned by Aristotle. Thomas Bartholin mentions four kinds of luminous insects, two with wings, and two without; but in hot climates travellers say they are found in much greater numbers, and of different species. Columna, an industrious naturalist, observes, that their light is not extinguished immediately upon the death of the animal.

The first distinct account that we meet with of light proceeding from putrescent animal-flesh is that which is given by Fabricius ab Aquapendente; who says, that when three Roman youths, residing at Padua, had bought a lamb, and had eaten part of it on Easter day 1592, several pieces of the remainder, which they kept till the day following, shone like so many candles when they were casually viewed in the dark. Part of this luminous flesh was immediately sent to Aquapendente, who was professor of anatomy in that city. He observed, that both the lean and the fat of this meat shone with a whitish kind of light; and also took notice, that some pieces of kid's flesh, which had happened to have lain in contact with it, was luminous, as well as the fingers and other parts of the bodies of those persons who touched it. Those parts, he observed, shone the most which were soft to the touch, and seemed to be transparent in candle light; but

where the flesh was thick and solid, or where a bone was near the outside, it did not shine.

After this appearance, we find no account of any other similar to it, before that which was observed by Bartholin, and of which he gives a very pompous description in his ingenious treatise already quoted. This happened at Montpelier in 1641, when a poor old woman had bought a piece of flesh in the market, intending to make use of it the day following. But happening not to be able to sleep well that night, and her bed and pantry being in the same room, she observed so much light come from the flesh, as to illuminate all the place where it hung. A part of this luminous flesh was carried as a curiosity to Henry Bourbon, duke of Condé, the governor of the place, who viewed it for several hours with the greatest astonishment.

This light was observed to be whitish; and not to cover the whole surface of the flesh, but certain parts only, as if gems of unequal splendor had been scattered over it. This flesh was kept till it began to putrify, when the light vanished; which, as some religious people fancied, it did in the form of a cross.

It is natural to expect, that the almost universal experimental philosopher Mr Boyle should try the effect of his air-pump upon these luminous substances. Accordingly we find that he did not fail to do it; when he presently found that the light of rotten wood was extinguished in *vacuo*, and revived again on the admission of the air, even after a long continuance in *vacuo*; but the extinguishing of this light was not so complete immediately upon exhausting the receiver, as some little time afterwards. He could not perceive, however, that the light of rotten wood was increased in condensed air; but this, he imagined, might arise from his not being able to judge very well of the degree of light, through so thick and cloudy a glass-vessel as he then made use of; but we find that the light of a shining fish, which was put into a condensing engine before the Royal Society, in 1668, was rendered more vivid by that means. The principal of Mr Boyle's experiments were made in October 1667.

This philosopher attended to a great variety of circumstances relating to this curious phenomenon. Among other things he observed, that change of air was not necessary to the maintenance of this light; for it continued a long time when a piece of the wood was put into a very small glass hermetically sealed, and it made no difference when this tube which contained the wood was put into an exhausted receiver. This he also observed with respect to a luminous fish, which he put into water, and placed in the same circumstances. He also found, that the light of shining fishes had other properties in common with that of shining wood; but the latter, he says, was presently quenched with water, spirit of wine, a great variety of saline mixtures, and other fluids. Water, however, did not quench all the light of some shining veal on which he tried it, though spirit of wine destroyed its virtue presently.

Mr Boyle's observation of light proceeding from flesh-meat was quite casual. On the 15th of February 1662, one of his servants was greatly alarmed with the shining of some veal, which had been kept a few days, but had no bad smell, and was in a state very proper for use. The servant immediately made his master acquainted with this extraordinary appearance

Light.

Works,
vol. iii.
Ac. p. 156

Birch's life
ii. 254

De luce animal.
p. 183.
206.

34.
Light from
putrid flesh.

De Visione,
p. 45.

Light.
Birch, ii.
70.

ance; and though he was then in bed, he ordered it to be immediately brought to him, and he examined it with the greatest attention. Suspecting that the state of the atmosphere had some share in the production of this phenomenon, he takes notice, after describing the appearance, that the wind was south-west and blustering, the air hot for the season, the moon was past its last quarter, and the mercury in the barometer was at $29\frac{1}{2}$ inches.

35
Light from
fishes.

Mr Boyle was often disappointed in his experiments on shining fishes; finding that they did not always shine in the very same circumstances, as far as he could judge, with others which had shined before. At one time that they failed to shine, according to his expectations, he observed that the weather was variable, and not without some days of frost and snow. In general he made use of whittings, finding them the fittest for his purpose. In a discourse, however, upon this subject at the Royal Society in 1681, it was asserted, that, of all fishy substances, the eggs of lobsters, after they had been boiled, shone the brightest. Olig. Jacobæus observes, that, upon opening a sea-polypus, it was so luminous, as to startle several persons who saw it; and he says, that the more putrid the fish was, the more luminous it grew. The nails also, and the fingers of the persons who touched it, became luminous; and the black liquor which issued from the animal, and which is its bile, shone also, but with a very faint light.

As. Hafs.
vol. v.
p. 282.

Mr Boyle draws a minute comparison between the light of burning coals and that of shining wood or fish, showing in what particulars they agree, and in what they differ. Among other things he observes, that extreme cold extinguishes the light of shining wood, as appeared when a piece of it was put into a glass tube, and held in a frigorific mixture. He also found that rotten wood did not waite itself by shining, and that the application of a thermometer to it did not discover the least degree of heat.

36
Of the pho-
las, a re-
markably
luminous
fish.

There is a remarkable shell-fish called PHOLAS, which forms for itself holes in various kinds of stone, &c. That this fish is luminous, was noticed by Pliny; who observes, that it shines in the mouth of the person who eats it, and, if it touch his hands or cloaths, makes them luminous. He also says that the light depends upon its moisture. The light of this fish has furnished matter for various observations and experiments to M. Reaumur, and the Bolognian academicians, especially Beccarius, who took so much pains with the subject of phosphoreal light.

M. Reaumur observes, that, whereas other fishes give light when they tend to putrefescence, this is more luminous in proportion to its being fresh; that when they are dried, their light will revive if they be moistened either with fresh or salt water, but that brandy immediately extinguishes it. He endeavoured to make this light permanent, but none of his schemes succeeded.

The attention of the Bolognian academicians was engaged to this subject by M. F. Marilius, in 1724, who brought a number of these fishes, and the stones in which they were inclosed, to Bologna, on purpose for their examination.

Com. Bonon.
vol. ii. 232.

Beccarius observed, that though this fish ceased to shine when it became putrid; yet that in its most putrid state, it would shine, and make the water in which

it was immersed luminous, when they were agitated. Galeatus and Montius found, that wine or vinegar extinguished this light: that in common oil it continued some days; but in rectified spirit of wine or urine, hardly a minute.

In order to observe in what manner this light was affected by different degrees of heat, they made use of a Reaumur's thermometer, and found that water rendered luminous by these fishes increased in light till the heat arrived to 45 degrees; but that it then became suddenly extinct, and could not be revived.

In the experiments of Beccarius, a solution of sea-salt increased the light of the luminous water, a solution of nitre did not increase it quite so much. Sal ammoniac diminished it a little, oil of tartar *per deliquium* nearly extinguished it, and the acids entirely. This water poured upon fresh calcined gypsum, rock crystal, cerus, or sugar, became more luminous. He also tried the effects of it when poured upon various other substances, but there was nothing very remarkable in them. Afterwards, using luminous milk, he found that oil of vitriol extinguished the light, but that oil of tartar increased it.

This gentleman had the curiosity to try how differently coloured substances were affected by this kind of light; and having, for this purpose, dipped several ribbons in it, the white came out the brightest, next to this was the yellow, and then the green; the other colours could hardly be perceived. It was not, however, any particular colour, but only light that was perceived in this case. He then dipped boards painted with the different colours, and also glass tubes, filled with substances of different colours, in water rendered luminous by the fishes. In both these cases the red was hardly visible, the yellow was the brightest, and the violet the dullest. But on the boards the blue was nearly equal to the yellow, and the green more languid; whereas in the glasses, the blue was inferior to the green.

Of all the liquors into which he put the pholades, milk was rendered the most luminous. A single pholas made seven ounces of milk so luminous, that the faces of persons might be distinguished by it, and it looked as if it was transparent.

Air appeared to be necessary to this light; for when Beccarius put the luminous milk into glass tubes, no agitation would make it shine, unless bubbles of air were mixed with it. Also Montius and Galeatus found, that, in an exhausted receiver, the pholas lost its light, but the water was sometimes made more luminous; which they ascribed to the rising of bubbles of air through it.

Beccarius, as well as Reaumur, had many schemes to render the light of these pholades permanent. For this purpose he kneaded the juice into a kind of paste, with flour, and found that it would give light when it was immersed in warm water; but it answered best to preserve the fish in honey. In any other method of preservation, the property of becoming luminous would not continue longer than six months, but in honey it had lasted above a year; and then it would, when plunged in warm water, give as much light as ever it had done.

Similar, in some respects, to those observations on the light of the pholas, was that which was observed

Light.

As. Casse.
vol. v.
p. 485.

Light.

to proceed from wood which was moist, but not in a putrid state, which was very conspicuous in the dark.

That the sea is sometimes luminous, especially when it is put in motion by the dashing of oars or the beating of it against a ship, has been observed with admiration by a great number of persons. Mr Boyle, after reciting all the circumstances of this appearance, as far as he could collect them from the accounts of navigators; as its being extended as far as the eye could reach, and at other times being visible only when the water was dashed against some other body; that, in some seas, this phenomenon is accompanied by some particular winds, but not in others; and that sometimes one part of the sea will be luminous, when another part, not far from it, will not be so; concludes with saying, that he could not help suspecting that these odd phenomena, belonging to great masses of water, were in some measure owing to some cosinical law or cullom of the terrestrial globe, or at least of the planetary vortex.

Some curious observations on the shining of some fishes, and the pickle in which they were immerged, were made by Dr Beal, in May 1665; and had they been properly attended to and pursued, might have led to the discovery of the cause of this appearance. Having put some boiled mackerel into water, together with salt and sweet herbs; when the cook was, some time after, stirring it, in order to take out some of the fishes, he observed, that, at the first motion, the water was very luminous; and that the fish shining through the water added much to the light which the water yielded. The water was of itself thick and blackish, rather than of any other colour; and yet it shined on being stirred, and at the same time the fishes appeared more luminous than the water. Wherever the drops of this water, after it had been stirred, fell to the ground, they shined; and the children in the family diverted themselves with taking the drops, which were as broad as a penny, and running with them about the house. The cook observed, that, when she turned up that side of the fish that was lowest, no light came from it; and that, when the water had settled for some time, it did not shine at all. The day following, the water gave but little light, and only after a brisk agitation, though the fishes continued to shine as well from the inside as the outside, and especially about the throats, and such places as seemed to have been a little broken in the boiling.

When, in the light of the sun, he examined, with a microscope, a small piece of a fish which had shined very much the night before, he found nothing remarkable on its surface, except that he thought he perceived what he calls a *steam*, rather dark than luminous, arising like a very small dust from the fish, and here and there a very small and almost imperceptible spark. Of the sparkles he had no doubt; but he thought it possible that the steam might be a deception of the sight, or some dust in the air.

Finding the fish to be quite dry, he moistened it with his spittle; and then observed that it gave a little light, though but for a short time. The fish at that time was not fed, nor yet insipid to the best discerning palate. Two of the fishes he kept two or three days longer for farther trial: but, the weather being very hot, they became fetid; and, contrary to his ex-

pectations, there was no more light produced either by the agitation of the water or in the fish.

Father Bourzes, in his voyage to the Indies in 1704, took particular notice of the luminous appearance of the sea. The light was sometimes so great, that he could easily read the title of a book by it, though he was nine or ten feet from the surface of the water. Sometimes he could easily distinguish, in the wake of the ship, the particles that were luminous from those that were not; and they appeared not to be all of the same figure. Some of them were like points of light, and others such as stars appear to the naked eye. Some of them were like globes, of a line or two in diameter; and others as big as one's head. Sometimes they formed themselves into squares of three or four inches long, and one or two broad. Sometimes all these different figures were visible at the same time; and sometimes there were what he calls *vortices* of light, which as one particular time appeared and disappeared immediately like flashes of lightning.

Nor did only the wake of the ship produce this light, but fishes also, in swimming, left so luminous a track behind them, that both their size and species might be distinguished by it. When he took some of the water out of the sea, and stirred it ever so little with his hand, in the dark, he always saw in it an infinite number of bright particles; and he had the same appearance whenever he dipped a piece of linen in the sea, and wrung it in a dark place, even though it was half dry; and he observed, that when the sparkles fell upon any thing that was solid, it would continue shining for some hours together.

After mentioning several circumstances which did not contribute to this appearance, this Father observes, that it depends very much upon the *quality of the water*, and he was pretty sure that this light is the greatest, when the water is fattest, and fullest of foam. For in the main sea, he says, the water is not everywhere equally pure; and that sometimes, if linen be dipped in the sea, it is clammy when it is drawn up again; and he often observed, that when the wake of the ship was the brightest, the water was the most fat and glutinous, and that linen moistened with it produced a great deal of light, if it was stirred or moved briskly. Besides, in some parts of the sea, he saw a substance like saw-dust, sometimes red and sometimes yellow; and when he drew up the water in those places, it was always viscous and glutinous. The sailors told him, that it was the spawn of whales; that there are great quantities of it in the north; and that sometimes, in the night, they appeared all over of a bright light, without being put in motion by any vessel or fish passing by them.

As a confirmation of this conjecture, that the more glutinous the sea-water is, the more it is disposed to become luminous, he observes, that one day they took a fish which was called a *bonite*, the inside of the mouth of which was so luminous, that, without any other light, he could read the same characters which he had before read by the light in the wake of the ship; and the mouth of this fish was full of a viscous matter, which, when it was rubbed upon a piece of wood, made it immediately all over luminous; though, when the moisture was dried up, the light was extinguished.

The abbé Nollet was much struck with the lumi-

Light.

39
Father
Bourzes's
account of
luminous
sea-water.

40
His conjecture
cures concerning the
cause.

37
Light from
sea-water.

38
Dr Beal's
experiments on
fishes.

Phil. Trans.
vol. lix.
p. 450.

Light.
41
Abbé Nol-
let's theory.

nousness of the sea when he was at Venice in 1749; and, after taking a great deal of pains to ascertain the circumstances of it, concluded that it was occasioned by a shining insect; and having examined the water very often, he at length did find a small insect, which he particularly describes, and to which he attributes the light. The same hypothesis had also occurred to M. Vianelli, professor of medicine in Chioggia near Venice; and both he and M. Grizzolini, a physician in Venice, have given drawings of the insects from which they imagined this light to proceed.

The abbé was the more confirmed in his hypothesis, by observing, some time after, the motion of some luminous particles in the sea. For, going into the water, and keeping his head just above the surface, he saw them dart from the bottom, which was covered with weeds, to the top, in a manner which he thought very much resembled the motions of insects; though, when he endeavoured to catch them, he only found some luminous spots upon his handkerchief, which were enlarged when he pressed them with his finger.

42
Observa-
tions of M.
le Roi.

M. le Roi, making a voyage on the Mediterranean, presently after the abbé Nollet made his observations at Venice, took notice, that in the day-time, the prow of the ship in motion threw up many small particles, which, falling upon the water, rolled upon the surface of the sea for a few seconds before they mixed with it; and in the night the same particles, as he concluded, had the appearance of fire. Taking a quantity of the water, the same small sparks appeared whenever it was agitated; but, as was observed with respect to Dr Beal's experiments, every successive agitation produced a less effect than the preceding, except after being suffered to rest a while; for then a fresh agitation would make it almost as luminous as the first. This water, he observed, would retain its property of shining by agitation a day or two; but it disappeared immediately on being set on the fire, though it was not made to boil.

Memoirs
Presentes,
vol. III. 144.

This gentleman, after giving much attention to this phenomenon, concludes, that it is not occasioned by any shining insects, as the abbé Nollet imagined; especially as, after carefully examining some of the luminous points, which he caught upon an handkerchief, he found them to be round like large pins heads, but with nothing of the appearance of any animal, though he viewed them with a microscope. He also found, that the mixture of a little spirit of wine with water just drawn from the sea, would give the appearance of a great number of little sparks, which would continue visible longer than those in the ocean. All the acids, and various other liquors, produced the same effect, though not quite so conspicuously; but no fresh agitation would make them luminous again. M. le Roi is far from asserting that there are no luminous insects in the sea. He even supposes that the abbé Nollet and M. Vianelli had found them. But he was satisfied that the sea is luminous chiefly on some other account, though he does not so much as advance a conjecture about what it is.

43
Experi-
ments by
M. Ant.
Martin.

M. Ant. Martin made many experiments on the light of fishes, with a view to discover the cause of the light of the sea. He thought that he had reason to conclude, from a great variety of experiments, that all
N° 182.

sea-fishes have this property; but that it is not to be found in any that are produced in fresh water. Nothing depended upon the colour of the fishes, except that he thought that the white ones, and especially those that had white scales, were a little more luminous than others. This light, he found, was increased by a small quantity of salt; and also by a small degree of warmth, though a greater degree extinguished it. This agrees with another observation of his, that it depends entirely upon a kind of moisture which they had about them, and which a small degree of heat would expel, when an oiliness remained which did not give this light, but would burn in the fire. Light from the flesh of birds or beasts is not so bright, he says, as that which proceeds from fish. Human bodies, he says, have sometimes emitted light about the time that they began to putrefy, and the walls and roof of a place in which dead bodies had often been exposed, had a kind of dew or clamminess upon it, which was sometimes luminous; and he imagined that the lights which are said to be seen in burying-grounds may be owing to this cause.

Light.
Sved.
Abhand.
vol. xxiii.
p. 235.

From some experiments made by Mr Canton, he concludes, that the luminousness of sea-water is owing to the slimy and other putrescent substances it contains. On the evening of the 14th of June 1768, he put a small fresh whiting into a gallon of sea-water, in a pan which was about 14 inches in diameter, and took notice that neither the whiting nor the water, when agitated, gave any light. A Fahrenheit's thermometer, in the cellar where the pan was placed, stood at 54°. The 15th, at night, that part of the fish which was even with the surface of the water was luminous, but the water itself was dark. He drew the end of a stick through it, from one side of the pan to the other; and the water appeared luminous behind the stick all the way, but gave light only where it was disturbed. When all the water was stirred, the whole became luminous, and appeared like milk, giving a considerable degree of light to the sides of the pan; and it continued to do so for some time after it was at rest. The water was most luminous when the fish had been in it about 28 hours; but would not give any light by being stirred, after it had been in it three days.

44
Canton.

He then put a gallon of fresh water into one pan, and an equal quantity of sea-water into another, and into each pan he put a fresh herring of about three ounces. The next night the whole surface of the sea-water was luminous, without being stirred; but it was much more so when it was put in motion; and the upper part of the herring, which was considerably below the surface of the water, was also very bright; while at the same time, the fresh water, and the fish that was in it, were quite dark. There were several very bright luminous spots on different parts of the surface of the sea-water; and the whole, when viewed by the light of a candle, seemed covered with a greasy scum. The third night, the light of the sea-water, while at rest, was very little, if at all, less than before; but when stirred, its light was so great as to discover the time by a watch, and the fish in it appeared as a dark substance. After this, its light was evidently decreasing, but was not quite gone before the 7th night.

The

Light.

The fresh water and the fish in it were perfectly dark during the whole time. The thermometer was generally above 60°.

The preceding experiments were made with sea-water; but he now made use of other water, into which he put common or sea-salt, till he found, by an hydrometer, that it was of the same specific gravity with the sea-water; and, at the same time, in another gallon of water, he dissolved two pounds of salt; and into each of these waters he put a small fresh herring. The next evening the whole surface of the artificial sea-water was luminous without being stirred; but gave much more light when it was disturbed. It appeared exactly like the real sea-water in the preceding experiment; its light lasted about the same time, and went off in the same manner: while the other water, which was almost as salt as it could be made, never gave any light. The herring which was taken out of it the seventh night, and washed from its salt, was found firm and sweet; but the other herring was very soft and putrid, much more so than that which had been kept as long in fresh water. If a herring, in warm weather, be put into 10 gallons of artificial sea-water, instead of one, the water, he says, will still become luminous, but its light will not be so strong.

It appeared by some of the first observations on this subject, that heat extinguishes the light of putrescent substances. Mr Canton also attended to this circumstance; and observes, that though the greatest summer heat is well known to promote putrefaction, yet 20 degrees more than that of the human blood seems to hinder it. For putting a small piece of a luminous fish into a thin glass ball, he found, that water of the heat of 118 degrees would extinguish its light in less than half a minute; but that, on taking it out of the water, it would begin to recover its light in about 10 seconds; but it was never afterwards so bright as before.

Mr Canton made the same observation that Mr Ant. Martin had done, viz. that several kinds of river fish could not be made to give light, in the same circumstances in which any sea-fish became luminous. He says, however, that a piece of carp made the water very luminous, though the outside, or scaly part of it, did not shine at all.

For the sake of those persons who may choose to repeat his experiments, he observes, that artificial sea-water may be made without the use of an hydrometer, by the proportion of four ounces avoirdupois of salt to seven pints of water, wine-measure.

From undoubted observations, however, it appears, that in many places of the ocean it is covered with luminous insects to a very considerable extent. Mr Dagelet, a French astronomer who returned from the Terra Australis in the year 1774, brought with him several kinds of worms which shine in water when it is set in motion; and M. Rigaud, in a paper inserted (if we are not mistaken) in the Journal des Scavans for the month of March 1770, affirms, that the luminous surface of the sea, from the port of Brest to the Antilles, contains an immense quantity of little, round, shining poly-

VOL. X. Part I.

puces of about a quarter of a line in diameter. Other learned men, who acknowledge the existence of these luminous animals, cannot, however, be persuaded to consider them as the cause of all that light and scintillation that appear on the surface of the ocean: they think that some substance of the phosphorus kind, arising from putrefaction, must be admitted as one of the causes of this phenomenon. M. Godehouse has published curious observations on a kind of fish called in French *bonite*, already mentioned; and though he has observed, and accurately described, several of the luminous insects that are found in sea-water, he is, nevertheless, of opinion, that the scintillation and flaming light of the sea proceed from the oily and greasy substances with which it is impregnated.

The abbé Nollet was long of opinion, that the light of the sea proceeded from electricity (A); though he afterwards seemed inclined to think, that this phenomenon was caused by small animals, either by their luminous aspect, or at least by some liquor or effluvia which they emitted. He did not, however, exclude other causes; among these, the spawn or fry of fish deserves to be noticed. M. Dagelet, sailing into the bay of Antongil, in the island of Madagascar, observed a prodigious quantity of fry, which covered the surface of the sea above a mile in length, and which he at first took for banks of sand on account of their colour; they exhaled a disagreeable odour, and the sea had appeared with uncommon splendor some days before. The same accurate observer, perceiving the sea remarkably luminous in the road of the Cape of Good Hope during a perfect calm, remarked, that the oars of the canoes produced a whitish and pearly kind of lustre; when he took in his hand the water which contained this phosphorus, he discerned in it, for some minutes, globules of light as large as the heads of pins. When he pressed these globules, they appeared to his touch like a soft and thin pulp; and some days after the sea was covered near the coasts with whole banks of these little fish in innumerable multitudes.

To putrefaction, also, some are willing to attribute that luminous appearance which goes by the name of *ignis fatuus*, to which the credulous vulgar ascribe very extraordinary and especially mischievous powers. It is most frequently observed in boggy places and near rivers, though sometimes also in dry places. By its appearance benighted travellers are said to have been sometimes misled into marshy places, taking the light which they saw before them for a candle at a distance; from which seemingly mischievous property it has been thought by the vulgar to be a spirit of a malignant nature, and been named accordingly *Will with a wisp*, or *Jack with a lantern*; for the same reason also it probably had its Latin name *ignis fatuus*.

This kind of light is said to be frequent about burying places and dung-hills. Some countries are also remarkable for it, as about Bologna in Italy, and some parts of Spain and Ethiopia. Its forms are so uncertain and variable that they can scarce be described, especially as few philosophical observers ever had the good fortune to meet with it. Dr Derham, however,

G

happened

Light.

46

Ignis fatuus.

45
The ocean
luminous
from in-
sects.

(A) This hypothesis was also maintained in a treatise published at Venice in 1746, by an officer in the Austrian Service, under the title, *Deſt Elektriciſm*.

Light

happened one night to perceive one of them, and got so near that he could have a very advantageous view of it. This is by no means easy to be obtained; for, among other singularities of the *ignis fatuus*, it is observed to avoid the approach of any person, and fly from place to place as if it was animated. That which Dr Derham observed was in some boggy ground betwixt two rocky hills; and the night was dark and calm; by which means, probably, he was enabled to advance within two or three yards of it. It appeared like a complete body of light without any division, so that he was sure it could not be occasioned by insects as some have supposed; the separate lights of which he could not have failed to distinguish, had it been occasioned by them. The light kept dancing about a dead thistle, till a very slight motion of the air, occasioned, as he supposed, by his near approach to it, made it jump to another place; after which it kept flying before him as he advanced. M. Beccari endeavoured to procure all the intelligence he could concerning this phenomenon, by inquiring of all his acquaintance who might have had an opportunity of observing it. Thus he obtained information that two of these lights appeared in the plains about Bologna, the one to the north, and the other to the south, of that city, and were to be seen almost every dark night, especially that to the eastward, giving a light equal to an ordinary faggot. The latter appeared to a gentleman of his acquaintance as he was travelling; moved constantly before him for about a mile; and gave a better light than a torch which was carried before him. Both these appearances gave a very strong light, and were constantly in motion, though this was various and uncertain. Sometimes they would rise, sometimes sink; but commonly they would hover about six feet from the ground; they would also frequently disappear on a sudden, and appear again in some other place. They differed also in size and figure, sometimes spreading pretty wide, and then contracting themselves; sometimes breaking into two, and then joining again. Sometimes they would appear like waves, at others they would seem to drop sparks of fire: they were but little affected by the wind; and in wet and rainy weather were frequently observed to cast a stronger light than in dry weather: they were also observed more frequently when snow lay upon the ground, than in the hottest summer; but he was assured that there was not a dark night throughout the whole year in which they were not to be seen. The ground to the eastward of Bologna, where the largest of these appearances was observed, is a hard chalky soil mixed with clay, which will retain the moisture for a long time, but breaks and cracks in hot weather. On the mountains, where the soil is of a looser texture, and less capable of retaining moisture, the *ignis fatui* were less.

From the best information which M. Beccari was able to procure, he found that these lights were very frequent about rivers and brooks. He concludes his narrative with the following singular account. "An intelligent gentleman travelling in the evening, between eight and nine, in a mountainous road about ten miles south of Bologna, perceived a light which shone very strangely upon some stones which lay on the banks

of the river Rivoerde. It seemed to be about two feet above the stones, and not far from the water. In size and figure it had the appearance of a paralleloiped, somewhat more than a foot in length, and half a foot high, the longest side being parallel to the horizon. Its light was so strong, that he could plainly discern by it part of a neighbouring hedge and the water of the river; only in the east corner of it the light was rather faint, and the square figure less perfect, as if it was cut off or darkened by the segment of a circle. On examining it a little nearer, he was surprised to find that it changed gradually from a bright red, first to a yellowish, and then to a pale colour, in proportion as he drew nearer; and when he came to the place itself, it quite vanished. Upon this he stepped back, and not only saw it again, but found that the farther he went from it, the stronger and brighter it grew. When he examined the place of this luminous appearance, he could perceive no smell nor any other mark of fire." This account was confirmed by another gentleman, who informed M. Beccari, that he had seen the same light five or six different times in spring and in autumn; and that it always appeared of the same shape, and in the very same place. One night in particular, he observed it come out of a neighbouring field to settle in the usual place.

A very remarkable account of an *ignis fatuus* is given by Dr Shaw in his Travels to the Holy Land. It appeared in the valleys of mount Ephraim, and attended him and his company for more than an hour. Sometimes it would appear globular, or in the shape of the flame of a candle; at others it would spread to such a degree as to involve the whole company in a pale inoffensive light, then contract itself, and suddenly disappear; but in less than a minute would appear again; sometimes running swiftly along, it would expand itself at certain intervals over more than two or three acres of the adjacent mountains. The atmosphere from the beginning of the evening had been remarkably thick and hazy; and the dew, as they felt it on the bridles of their horses, was very clammy and unctuous.

Lights resembling the *ignis fatuus* are sometimes observed at sea, skipping about the masts and rigging of ships; and Dr Shaw informs us, that he has seen these in such weather as that just mentioned when he saw the *ignis fatuus* in Palestine. Similar appearances have been observed in various other situations; and we are told of one which appeared about the bed of a woman in Milan, surrounding it as well as her body entirely. This light fled from the hand which approached it; but was at length entirely dispersed by the motion of the air. Of the same kind also, most probably, are those small luminous appearances which sometimes appear in houses or near them, called in Scotland *Elf-candles*, and which are supposed to portend the death of some person about the house. In general these lights are harmless, though not always; for we have accounts of some luminous vapours which would encompass stacks of hay and corn, and set them on fire; so that they became objects of great terror and concern to the country people. Of these it was observed, that they would avoid a drawn sword, or sharp-pointed iron instrument, and that they would be driven away by a great noise; both which methods

Light

were made use of to dissipate them; and it was likewise observed, that they came from some distance, as it were on purpose to do mischief.

Several philosophers have endeavoured to account for these appearances, but hitherto with no great success; nor indeed does there seem to be sufficient data for solving all their phenomena. Willoughby, Ray, and others, have imagined that the light was occasioned by a number of shining insects; but this opinion was never supported in such a manner as to gain much ground. The *ignis fatuus* seen by Dr Derham above mentioned, as well as all the other instances we have related, seem to demonstrate the contrary. Sir Isaac Newton calls it a vapour shining without heat; and supposes that there is the same difference between the vapour of *ignis fatuus* and flame, that there is between the shining of rotten wood and burning coals. But though this seems generally to be the case, there are still some exceptions, as has been instanced in the vapours which set fire to the stacks of corn. Dr Priestley supposes that the light is of the same nature with that produced by putrescent substances; and others are of opinion, that the electrical fluid is principally concerned; but none have attempted to give any particular solution of the phenomena.

From the frequent appearance of the *ignis fatuus* in marshes, moist ground, burying places, and dung-hills, we are naturally led to conclude, that putrefaction is concerned in the production of it. This process, we know, is attended with the emission of an aqueous steam, together with a quantity of fixed, inflammable, phlogisticated, and alkaline airs, all blended together in one common vapour. It is likewise attended with some degree of heat; and we know that there are some vapours, that of sulphur particularly, which become luminous, with a degree of heat much less than that sufficient to set fire to combustible bodies. There is no inconsistency, therefore, in supposing that the putrid vapour may be capable of shining with a still smaller degree of heat than that of sulphur, and consequently become luminous by that which putrefaction alone affords. This would account for the *ignis fatuus*, were it only a steady luminous vapour arising from places where putrid matters are contained; but its extreme mobility, and flying from one place to another on the approach of any person, cannot be accounted for on this principle. If one quantity of the putrid vapour becomes luminous by means of heat, all the rest ought to do so likewise: so that though we may allow heat and putrefaction to be concerned, yet of necessity we must have recourse to some other agent, which cannot be any other than electricity. Without this it is impossible to conceive how any body of moveable vapour should not be carried away by the wind; but, so far is this from being the case, that the *ignis fatuus* described by M. Beccari were but little affected by the wind. It is besides proved by undoubted experiment, that electricity always is attended with some degree of heat; and this, however small, may be sufficient to give a luminous property to any vapour on which it acts strongly; not to mention, that the electric fluid itself is no other than that of light, and may therefore by its action easily produce a luminous appearance independent of any vapour.

We have a strong proof that electricity is concerned, or indeed the principal agent, in producing the *ignis fatuus* from an experiment related by Dr Priestley of a flame of this kind being artificially produced. A gentleman, who had been making many electrical experiments for a whole afternoon in a small room, on going out of it, observed a flame following him at some little distance. This, we have no reason to doubt, was a true *ignis fatuus*, and the circumstances necessary to produce it were then present, viz. an atmosphere impregnated with animal vapour, and likewise strongly electrified. Both these circumstances undoubtedly must have taken place in the present case; for the quantity of perspiration emitted by a human body is by no means inconsiderable; and it as well as the electricity would be collected by reason of the smallness of the room. In this case, however, there seems to have been a considerable difference between the artificial *ignis fatuus* and those commonly met with; for this flame followed the gentleman as he went out of the room; but the natural ones commonly fly from those who approach them. This may be accounted for, from a difference between the electricity of the atmosphere in the one room and the other; in which case the flame would naturally be attracted towards that place where the electricity was either different in quality or in quantity; but in the natural way, where all bodies may be supposed equally electrified for a great way round, a repulsion will as naturally take place. Still, however, this does not seem to be always the case. In those instances where travellers have been attended by an *ignis fatuus*, we cannot suppose it to have been influenced by any other power than what we call attraction, and which electricity is very capable of producing. Its keeping at some distance is likewise easily accounted for; as we know that bodies possessed of different quantities of electricity may be made to attract one another for a certain space, and then repel without having ever come into contact. On this principle we may account for the light which surrounded the woman at Milan, but fled from the hand of any other person. On the same principle may we account for these mischievous vapours which set fire to the hay and corn stacks, but were driven away by presenting to them a pointed iron instrument, or by making a noise. Both these are known to have a great effect upon the electric matter; and by means of either, even lightning may occasionally be made to fall upon or to avoid particular places, according to the circumstances by which the general mass happens to be affected at that time.

On the whole, therefore, it seems most probable, that the *ignis fatuus* is a collection of vapour of the putrescent kind, very much affected by electricity; according to the degree of which, it will either give a weak or strong light, or even set fire to certain substances disposed to receive its operation. This opinion seems greatly to be confirmed from some luminous appearances observed in privies, where the putrid vapours have even collected themselves into balls, and exploded violently on the approach of a candle. This last effect, however, we cannot so well ascribe to the electricity, as to the accession of the inflammable air which frequently abounds in such places.

Light.

experiments and observations on air, Mr Warrtine gives an account of some very remarkable *ignes fatui*, which he observed on the road to Bromgrove, about five miles from Birmingham. The time of observation was the 12th of December 1776, before day-light. A great many of these lights were playing in an adjacent field, in different directions; from some of which there suddenly sprang up bright branches of light, something resembling the explosion of a rocket that contained many brilliant stars, if the discharge was upwards, instead of the usual direction, and the hedge and trees on each side of the hedge were illuminated. This appearance continued but a few seconds, and then the jack-a-lanterns played as before. Mr Warrtine was not near enough to observe if the apparent explosions were attended with any report.

Cronstedt gives it as his opinion, that *ignes fatui*, as well as the meteors called *falling stars*, are owing to collections of inflammable air raised to a great height in the atmosphere. But, with regard to the latter, the vast height at which they move evidently shows that they cannot be the effect of any *gravitating* vapour whatever; for the lightest inflammable air is one-twelfth of that of the common atmosphere: and we have no reason to believe, that at the distance of 40 or 50 miles from the earth, the latter has near $\frac{1}{12}$ of its weight at the surface. From the account given by Mr Warrtine, we should be apt to conclude, that there is a strong affinity betwixt the *ignes fatui* and fire-balls, inasmuch that the one might be very easily converted into the other. From this then we must ascribe an electrical origin to the one as well as the other. Electricity, we know, can assume both these appearances, as is evident in the case of points; or even when the atmosphere is violently electrified, as around the string of an electrical kite, which always will appear to be surrounded with a blue flame in the night, if the electricity be very strong.

On the whole, it appears, that electricity acting upon a small quantity of atmospheric air, with a certain degree of vigour, will produce an appearance resembling an *ignes fatui*; with a superior force it will produce a fire-ball; and a sudden increase of electrical power might produce those sparks and apparent explosions observed by Mr Warrtine. The only difficulty therefore is, Why does electricity exert its power upon one portion of the atmosphere rather than another, seeing it has an opportunity of diffusing itself equally through the whole? To this it seems impossible to give any other reason than that we see the fact is so; and that in all cases where there is a quantity of electrified air or vapour, there will be an accumulation in one part rather than another. Thus, in the experiment already related, where the gentleman perceived a blue flame following him, the whole air of the room was electrified, but the greatest power of the fluid was exerted on that which gave the luminous appearance.

With regard to the uses of the *ignes fatui* in the system of nature, we can only say, that they seem to be accidental appearances resulting from the motion of the electric fluid, and are, no doubt, like other meteors, subservient to the preservation of its equilibrium, and thus are useful in preventing those dreadful commotions which ensue when a proper medium for so doing is deficient.

Light.

A light in some respects similar to those above mentioned has been found to proceed from that celebrated chemical production called *phosphorus*, which always tends to decompose itself, so as to take fire by the access of air only. Phosphorus, therefore, when it emits light, is properly a body ignited; though when a very small quantity of it is used, as what is left after drawing it over paper, or what may be dissolved in essential oil, the heat is not sensible. But perhaps the matter which emits the light in what we call *putrescent substances* may be similar to it, though it be generated by a different process, and burn with a less degree of heat. Putrefaction does not seem to be necessary to the light of glow-worms, or of the pholades; and yet their light is sufficiently similar to that of shining wood or flesh. Electric light is unquestionably similar to that of phosphorus, though the source of it is apparently very different.

Kunkel formed his phosphorus into a kind of pills about the size of peas, which being moistened a little, and scraped in the dark, yielded a very considerable light, but not without smoke. The light was much more pleasing when eight or ten of these pills were put into a glass of water; for being shaken in the dark, the whole glass seemed to be filled with light. Kunkel also reduced his phosphorus into the form of larger stones; which being warmed by a person's hand, and rubbed upon paper, would describe letters that were very legible in the dark.

The greatest variety of experiments with the light of phosphorus was made by Dr Slare; who says, that the liquid phosphorus (which is nothing more than the solid phosphorus dissolved in any of the essential oils) would not hurt even a lady's hand; or that, when the hands or face were washed with it, it would not only make them visible to other persons in the dark, but that the light was so considerable as to make other neighbouring objects visible.

When the solid phosphorus is quite immersed in water, he observes that it ceases to shine; but that if any part of it chance to emerge, or get into the air, it will shine though the glass be hermetically sealed. In a large glass he kept it without water for several days; and yet it continued shining, with very little diminution of its light or weight. If the letters that were written with this phosphorus were warmed by the fire, they presently became dark lines, which continued upon the paper, like ink. To try how much light was given by a small quantity of this phosphorus, he observed that it continued to flame in the open air for seven or eight days; the light being visible whenever he shut his window.

As air was generally thought to contain the *pabulum* of flame, Dr Slare was determined to try this with respect to phosphorus; and for this purpose he placed a large piece of it in a receiver; but upon exhausting it, he perceived that it became more luminous, and that, upon admitting the air, it returned to its former state. This property of the light of phosphorus, which is the very reverse of that of shining wood and fishes, was also ascertained by several very accurate experiments of Mr Hauksbee's.

Endeavouring to blow the phosphorus into a flame with a pair of bellows, Dr Slare found that it was presently blown out, and that it was a considerable time before

47
phosphoric
light

Light.

before the light revived again. All liquors would extinguish this light when the phosphorus was put into them; nor would it shine or burn, though it was even boiled in the most inflammable liquors, as oil of olives, spirit of turpentine, or even spirit of wine.

In order to keep his phosphorus from confuming, he used to put it in a glass of water; and sometimes he has seen it, when thus immersed in water, make such bright and vigorous conflagrations in the air, as, he says, would surprise and frighten those who are not used to the phenomenon. This fiery meteor, he says, is contracted in its passage through the water, but expands as soon as it gets above it. If any person would make this experiment to advantage, he informs them that the glass must be deep and cylindrical, and not above three quarters filled with water. This effect he perceived in warm weather only, and never in cold.

The phosphorus of which we have been treating is prepared from urine; but in some cases the sweat, which is similar to urine, has been observed to be phosphoreous, without any preparation. This once happened to a person who used to eat great quantities of salt, and who was a little subject to the gout, after sweating with violent exercise. Stripping himself in the dark, his shirt seemed to be all on fire, which surprised him very much. Upon examination, red spots were found upon his shirt; and the physician who was present perceived an urinous smell, though it had nothing in it of volatile alkali, but of the muriatic acid; the same, he says, that issues from cabbage much salted, and strongly fermented.

The easiest method of accounting for all these kinds of lights, perhaps, is from electricity. If light consists in a certain vibration of the electric fluid†, then it follows, that in whatever substances such a vibration takes place, there light must appear, whether in putrescent animal substances, sea-water, phosphorus, or any thing else. We know that the electric matter pervades all terrestrial substances, and is very liable to be set in motion from causes of which we are ignorant. The action of the air by which putrefaction is produced may be one of these causes; and it can by no means appear surprising that the electric matter should act in the bodies of living animals in such a manner as to produce a permanent light, when we certainly know it acts in some of them so powerfully as to produce a shock similar to that of a charged vial.—On this subject we shall only observe farther, that when this vibration becomes so powerful as to penetrate the solid substance of the body itself, the luminous body then becomes transparent, as in the milk mentioned in the former part of this article; but, when it is only superficial, the body, though it emits light, is itself opaque.

Light from Diamonds. Among luminous bodies the diamond is to be reckoned; as some diamonds are known to shine in the dark. But on account of the feebleness of their splendor, it is necessary for the person who is to observe them, previously to stay in the dark at least a quarter of an hour; that the pupil of the eye may be dilated and enlarged, and so rendered capable of receiving a larger quantity of the rays of light. M. du Fay has also observed, that the eyes ought to be shut for this time, or at least one of them; and that, in that case, the light of the diamond is afterwards only seen by that eye which has been shut. Before the diamond is

Light.

brought into the dark room, it must be exposed to the sun-shine, or at least to the open day-light, to imbibe a sufficient quantity of rays; and this is done in one minute, or even less; eight or ten seconds having been found to furnish as much light as a stone is capable of receiving; and when brought into the dark, its light continues about twelve or thirteen minutes, weakening all the while by insensible degrees. It is very remarkable, that in bodies so extremely similar to each other as diamonds are, some should have this property of imbibing the sun's rays, and shining in the dark, and that others should not; yet so it is found to be by experiment, and the most nearly resembling stones shall be found one to have this property, and another to be destitute of it; while many of the most dissimilar have the property in common. There seems to be no rule, nor even the least traces of any imperfect rule of judging, which diamonds have, and which have not this property; their natural brightness, their purity, their size, or their shape, contribute nothing to it; and all that has been yet discovered of the least regularity among them, is, that all the yellow diamonds have this property. This may probably arise from their having more sulphur in their composition, and therefore illuminating more readily, or emitting a more visible flame.

The burning of diamonds is a term used among the jewellers, for putting them into a fierce fire, as they frequently do, when they are fouled with brown, or yellow, or the like; this always divests them of their colour, without doing them the least sensible injury. M. du Fay, having been informed of this common practice, formed a conjecture, that the difference of diamonds in their shining, or not shining in the dark, was owing to it; and that either all those which had been burnt, or all those which had not, were those which alone shone in the dark. But this was found an erroneous conjecture; for two diamonds, one lucid in the dark, the other not, were both burnt, and afterwards both were found to retain the same properties they had before. It is not only the open sunshine, or open day-light, which gives to these diamonds the power of shining in the dark; they receive it in the same manner, even if laid under a glass, or plunged in water or in milk.

M. du Fay tried whether it was possible to make the diamond retain, for any longer time, the light it naturally parts with so soon; and found, that if the diamond, after being exposed to the light, be covered with black wax, it will shine in the dark, as well six hours afterwards as at the time it was first impregnated with the light.

The imbibing light, in this manner, being so nice a property as it is to be found in several diamonds, it was not to be supposed that it would be found in any other stones: accordingly, on trial, the ruby, the sapphire, and the topaz, were found wholly destitute of it; and among a large number of rough emeralds, one only was found to possess it. Such is the strange uncertainty of these accidents.

All the other less precious stones were tried, and found not to possess this property of imbibing light from the day-light or sun-shine, but they all became luminous by the different means of heating or friction; with this difference, that some acquired it by one of these.

Atta Cefalaria,
vol. v.
p. 334.

§8.
All these
lights ac-
counted for
from elec-
tricity.
† See Elec-
tricity.

Light.

these methods, and others by the other; each being unaffected by that which gave the property to the other. The diamond becomes luminous by all these ways.

Beccarius also discovered, that diamonds have the property of the Bolognian phosphorus, about the same time that it occurred to M. du Fay. *Com. Bonon.* vol. ii. p. 276. M. du Fay likewise observed, that the common topaz, when calcined, had all the properties of this phosphorus; and pursuing the discovery, he found the same property, in a great degree, in the belemnites, gypsum, lime-stone, and marble: though he was obliged to dissolve some very hard substances of this kind in acids, before calcination could produce this change in them; and with some substances he could not succeed even thus; especially with flint-stones, river-sand, jaspers, agates, and rock-crystal.

LIGHT from Plants. In Sweden a very curious phenomenon has been observed on certain flowers by M. Haggren, lecturer in natural history. One evening he perceived a faint flash of light repeatedly dart from a marigold. Surprised at such an uncommon appearance, he resolved to examine it with attention; and, to be assured it was no deception of the eye, he placed a man near him, with orders to make a signal at the moment when he observed the light. They both saw it constantly at the same moment.

The light was most brilliant on marigolds of an orange or flame colour; but scarcely visible on pale ones.

The flash was frequently seen on the same flower two or three times in quick succession; but more commonly at intervals of several minutes: and when several flowers in the same place emitted their light together, it could be observed at a considerable distance.

This phenomenon was remarked in the months of July and August at sun-set, and for half an hour, when the atmosphere was clear; but after a rainy day, or when the air was loaded with vapours, nothing of it was seen.

The following flowers emitted flashes, more or less vivid, in this order:

1. The marigold, *galendula officinalis*.
2. Monk's-hood, *tropæolum majus*.
3. The orange-lily, *lilium bulbiferum*.
4. The Indian pink, *tagetes potula* & *erecta*.

To discover whether some little insects or phosphoric worms might not be the cause of it, the flowers were carefully examined, even with a microscope, without any such being found.

From the rapidity of the flash, and other circumstances, it may be conjectured that there is something of electricity in this phenomenon. It is well known, that when the pistil of a flower is impregnated, the pollen bursts away by its elasticity, with which electricity may be combined. But M. Haggren, after having observed the flash from the orange lily, the anthers of which are a considerable space distant from the petals, found that the light proceeded from the petals only; whence he concludes, that this electric light is caused by the pollen, which, in flying off, is scattered on the petals. Whatever be the cause, the effect is singular and highly curious.

LIGHTS, in painting, are those parts of a piece which are illuminated, or that lie open to the luminary,

by which the piece is supposed to be enlightened; and which, for this reason, are painted in bright vivid colours.

Light
||
Lightfoot.

In this sense, light is opposed to shadow.

Different lights have very different effects on a picture, and occasion a difference in the management of every part. A great deal therefore depends on the painter's choosing a proper light for his piece to be illuminated by; and a great deal more, in the conduct of the lights and shadows, when the luminary is pitched upon.

The strength and relief of a figure, as well as its gratefulness, depend entirely on the management of the lights, and the joining of those to the shadows.

The light a figure receives is either direct or reflected; to each of which special regard must be had. The doctrine of lights and shadows makes that part of painting called *châsse d'œuvre*.

LIGHT-HORSE, an ancient term in our English customs, signifying an ordinary cavalier or horseman lightly armed, and so as to enter a corps or regiment; in opposition to the men at arms, who were heavily accoutred, and armed at all points. See *Light-Horses*.

LIGHT-HOUSE, a building erected upon a cape or promontory on the sea-coast, or upon some rock in the sea, and having on its top in the night-time a great fire, or light formed by candles, which is constantly attended by some careful person, so as to be seen at a great distance from the land. It is used to direct the shipping on the coast, that might otherwise run ashore, or steer an improper course when the darkness of the night and the uncertainty of currents, &c. might render their situation with regard to the shore extremely doubtful. Lamp-lights are, on many occasions, preferable to coal-fires or candles; and the effect of these may be increased by placing them either behind glass-hemispheres, or before properly disposed glass or metal reflectors, which last method is now very generally adopted. See *BEACONS*.

LIGHT-ROOM, a small apartment, inclosed with glass-windows, near the magazine of a ship of war. It is used to contain the lights by which the gunner and his assistants are enabled to fill cartridges with powder to be ready for action.

LIGHTER, a large, open, flat-bottomed vessel, generally managed with oars, and employed to carry goods to or from a ship when he is to be laden or delivered.—There are also some lighters furnished with a deck throughout their whole length, in order to contain those merchandises which would be damaged by rainy weather: these are usually called *close lighters*.

LIGHTFOOT (John), a most learned English divine, was the son of a divine, and born in March 1602, at Stoke upon Trent in Staffordshire. After having finished his studies at a school on Morton-green near Congleton in Cheshire, he was removed in 1617 to Cambridge, where he applied himself to eloquence, and succeeded so well in it as to be thought the best orator of the under-graduates in the university. He also made an extraordinary proficiency in the Latin and Greek; but neglected the Hebrew, and even lost that knowledge he brought of it from school. His taste for the oriental languages was not yet excited; and as for logic, the study of it, as managed at that time among the academics, was too quarrelsome and fierce

fiere for his quiet and meek disposition. As soon as he had taken the degree of B. A. he left the university, and became assitant to a school at Repton in Derbyshire. After he had supplied this place a year or two, he entered into orders, and became curate of Norton under Hailes in Shropshire. This curacy gave an occasion of awakening his genius for the Hebrew tongue. Norton lies near Bellaport, then the seat of Sir Rowland Cotton; who was his constant hearer, made him his chaplain, and took him into his house. This gentleman being a perfect master of the Hebrew language, engaged Lightfoot in that study; who, by conversing with his patron, soon became sensible that without that knowledge it was impossible to attain an accurate understanding of the scriptures. He therefore applied himself to it with extraordinary vigour, and in a little time made a great progress in it: and his patron removing with his family to reside in London, at the request of Sir Alland Cotton his uncle, who was lord-mayor of that city, he followed his preceptor thither. But he did not stay long there: for, having a mind to improve himself by travelling abroad, he went down into Staffordshire to take leave of his father and mother. Passing through Stone in that county, he found the place destitute of a minister: and the pressing instances of the parishioners prevailed upon him to undertake that cure. Hereupon, laying aside his design of travelling abroad, he began to turn his thoughts upon settling at home. During his residence at Bellaport, he had fallen into the acquaintance of a gentleman who was daughter of William Crompton of Stonepark, Esq; and now, being in possession of that living, he married her in 1628. But notwithstanding this settlement, his unquenchable thirst after rabbinical learning would not suffer him to continue there. Sion-college library at London, he knew, was well stocked with books of that kind. He therefore quitted his charge at Stone, and removed with his family to Hornsey, near the city; where he gave the public a notable specimen of his advancement in those studies, by his "Erubhim, or Miscellanies Christian and Judaical," in 1629. He was at this time only 27 years of age; and appears to have been well acquainted with the Latin and the Greek fathers, as well as the ancient heathen writers. These first fruits of his studies were dedicated to Sir Rowland Cotton; who, in 1631, presented him to the rectory of Ashley in Staffordshire.

He seemed now to be fixed for life: Accordingly, he built a study in the garden, to be out of the noise of the house; and applied himself with indefatigable diligence in searching the scriptures. Thus employed, the days passed very agreeably; and he continued quiet and unmolested, till the great change which happened in the public affairs brought him into a share of the administration relating to the church; for he was nominated a member of the memorable assembly of divines for settling a new form of ecclesiastical polity. This appointment was purely the effect of his distinguished merit; and he accepted it purely with a view to serve his country, as far as lay in his power. The non-residence, which this would necessarily occasion, apparently induced him to resign his rectory: and having obtained the presentation for a younger brother, he set out for London in 1642. He had now

satisfied himself in clearing up many of the abstrusest passages in the Bible, and therein had provided the chief materials, as well as formed the plan, of his "Harmony;" and an opportunity of inspecting it at the press was, no doubt, an additional motive for his going to the capital; where he had not been long before he was chosen minister of St Bartholomew's, behind the Royal Exchange. The assembly of divines meeting in 1643, our author gave his attendance diligently there, and made a distinguished figure in their debates; where he used great freedom, and gave signal proofs of his courage as well as learning, in opposing many of those tenets which the divines were endeavouring to establish. His learning recommended him to the parliament, whose visitors, having ejected Dr William Spurstow from the mastership of Catharine-hall in Cambridge, put Lightfoot in his room, this year 1653; and he was also presented to the living of Much-Munden in Hertfordshire, void by the death of Dr Samuel Ward, Margaret-professor of divinity in that university, before the expiration of this year. Meanwhile he had his turn with other favourites in preaching before the house of commons, most of which sermons were printed; and in them we see him warmly pressing the speedy settlement of the church in the Presbyterian form, which he cordially believed to be according to the pattern in the Mount. He was all the while employed in preparing and publishing the several branches of his Harmony; all which were so many excellent specimens of the usefulness of human learning to true religion; and he met with great difficulties and discouragements in that work, chiefly from that antirenditional spirit which prevailed, and even threatened the destruction of the universities. In 1655 he entered upon the office of vice-chancellor of Cambridge, to which he was chosen that year, having taken the degree of doctor of divinity in 1652. He performed all the regular exercises for his degree with great applause, and executed the vice-chancellor's office with exemplary diligence and fidelity; and, particularly at the commencement, supplied the place of professor of divinity, then undisposed of, as an act which was kept for a doctor's degree in that profession. At the same time he was engaged with others in perfecting the Polyglott Bible, then in the press. At the Restoration he offered to resign the mastership of Catharine-hall: But, as what he had done had been rather in compliance with the necessity of the times, than from any zeal or spirit of opposition to the king and government, a confirmation was granted him from the crown, both of the place and of his living. Soon after this he was appointed one of the assistants at the conference upon the liturgy, which was held in the beginning of 1661, but attended only once or twice; probably disgusted at the heat with which that conference was managed. However, he stuck close to his design of perfecting his Harmony: and being of a strong and healthy constitution, which was assisted by an exact temperance, he prosecuted his studies with unabated vigour to the last, and continued to publish, notwithstanding the many difficulties he met with from the expense of it. However, not long before he died, some booksellers got a promise from him to collect and methodize his works, in order to print them; but the execution was prevented by his death, which happened Dec. 6. 1675. The doctor was twice married: his

first.

Lightning. first wife, already mentioned, brought him four sons and two daughters. His second wife was likewise a widow, and relict of Mr Austin Brograve, uncle of Sir Thomas Brograve, Bart. of Hertfordshire, a gentleman well versed in rabbinical learning, and a particular acquaintance of our author. He had no issue by her. She also died before him, and was buried in Munden church; where the doctor was himself likewise interred near both his wives. Dr Lightfoot's works were collected and published first in 1684, in two volumes folio. The second edition was printed at Amsterdam, 1686, in two volumes folio, containing all his Latin writings, with a Latin translation of those which he wrote in English. At the end of both these editions there is a list of such pieces as he left unfinished. It is the chief of these, in Latin, which make up the third volume, added to the former two, in a third edition of his works, by John Leusden, at Utrecht, in 1699, fol. They were communicated by Mr Strype, who, in 1700, published another collection of these papers, under the title of "Some genuine remains of the late pious and learned Dr John Lightfoot."

LIGHTNING, a bright and vivid flash of fire, suddenly appearing in the atmosphere, and commonly disappearing in an instant, sometimes attended with clouds and thunders, and sometimes not.

The phenomena of lightning are always surprising, and sometimes very terrible; neither is there any kind of natural appearance in which there is more diversity, not two flashes being ever observed exactly similar to one another. In a serene sky, the lightning, in this country at least, almost always hath a kind of indistinct appearance without any determinate form, like the sudden illumination of the atmosphere occasioned by firing a quantity of loose gunpowder; but when accompanied with thunder, it is well defined, and hath very often a zig-zag form. Sometimes it makes only one angle, like the letter V, sometimes it hath several branches, and sometimes it appears like the arch of a circle. But the most formidable and destructive form which lightning is ever known to assume is that of balls of fire. The motion of these is very often easily perceptible to the eye; but wherever they fall, much mischief is occasioned by their bursting, which they always do with a sudden explosion like that of fire-arms. Sometimes they will quietly run along, or rest for a little upon any thing, and then break into several pieces, each of which will explode; or the whole ball will burst at once, and produce its mischievous effects only in one place. The next to this in its destructive effects is the zig-zag kind; for that which appears like indistinct flashes, whose form cannot be readily observed, is seldom or never known to do hurt.—The colour of the lightning also indicates in some measure its power to do mischief; the palest and brightest flashes being most destructive; such as are red, or of a darker colour, commonly doing less damage.

A very surprising property of lightning, the zig-zag kind especially when near, is its seeming omnipresence. If two persons are standing in a room looking different ways, and a loud clap of thunder accompanied with zig-zag lightning happens, they will both distinctly see the flash, not only by that indi-

distinct illumination of the atmosphere which is occasioned by fire of any kind; but the very form of the lightning itself, and every angle it makes in its course, will be as distinctly perceptible, as though they had looked directly at the cloud from whence it proceeded. If a person happened at that time to be looking on a book, or other object which he held in his hand, he would distinctly see the form of the lightning between him and the object at which he looked. This property seems peculiar to lightning, and to belong to no other kind of fire whatever.

The effects of lightning are generally confined within a small space; and are seldom similar to those which accompany explosions of gun-powder, or of inflammable air in mines. Instances of this kind, however, have occurred; the following is one of the most remarkable of which we have any distinct account. "August 2. 1763, about six in the evening, there arose at Anderlight, about a league from Brussels, a conflict of several winds borne upon a thick fog. This conflict lasted four or five minutes, and was attended with a frightful hissing noise, which could be compared to nothing but the yellings of an infinite number of wild beasts. The cloud then opening, discovered a kind of very bright lightning, and in an instant the roofs of one side of the houses were carried off and dispersed at a distance; above 1000 large trees were broke off, some near the ground, others near the top, some torn up by the roots; and many both of the branches and tops carried to the distance of 60, 100, or 120 paces; whole coppices were laid on one side, as corn is by ordinary winds. The glass of the windows which were most exposed was shivered to pieces. A tent in a gentleman's garden was carried to the distance of 4000 paces; and a branch torn from a large tree, struck a girl in the forehead as she was coming into town, at the distance of 40 paces from the trunk of the tree, and killed her on the spot."

These terrible effects seem to have been owing to the prodigious agitation in the air, occasioned by the emission of such a vast quantity of lightning at once; or perhaps to the agitation of the electric fluid itself, which is still more dangerous than any concussion of the atmosphere; for thunder-storms will sometimes produce most violent whirlwinds, such as are by the best philosophers attributed to electricity, nay, even occasion an agitation of the waters of the ocean itself; and all this too after the thunder and lightning had ceased.—Of this we have the following instances. "Great Malvern, October 16. 1761. On Wednesday last, we had the most violent thunder ever known in the memory of man. At a quarter past four in the afternoon I was surprised with a most shocking and dismal noise; 100 forges (the nearest resemblance I can think of), were they all at work at once, could scarce equal it. I ran to the fore-door, and casting my eye upon the side of the hill about 400 yards to the south-west of my house, there appeared a prodigious smoke, attended with the same violent noise. I ran back into the house, and cried out, a volcano (for so I thought) had burst out of the hill; but I had no sooner got back again, than I found it had descended, and was passing on within about 100 yards of the south end of my house. It seemed to rise again in the meadow just below it; and

Lightning. continued its progress to the east, rising in the same manner for four different times, attended with the same dismal noise as at first; the air being filled with a nauseous and sulphureous smell. I saw it gradually decrease till quite extinguished in a turnip-field about a quarter of a mile below my house. The turnip leaves, with leaves of trees, dirt, sticks, &c. filled the air, and flew higher than any of these hills. The thunder ceased before this happened, and the air soon afterwards became calm and serene."—The vast column of smoke mentioned in the above letter was so large, that a physician of eminence at Worcester saw it in its progress down the hill, about a mile from Fecckenham, which is above 20 miles from Malvern.—In August 1763, a most violent storm of thunder, rain, and hail, happened at London, which did damage in the adjacent country, to the amount of 50,000*l*. Hailstones fell of an immense size, from two to ten inches circumference; but the most surprising circumstance was the sudden flux and reflux of the tide in Plymouth pool, exactly corresponding with the like agitation in the same place, at the time of the great earthquake at Lisbon.

Instances are also to be found, where lightning, by its own proper force, without any assistance from those less common agitations of the atmosphere or electric fluid, hath thrown stones of immense weight to considerable distances; torn up trees by the root, and broke them in pieces; shattered rocks; beat down houses, and set them on fire, &c.

Extraordinary effects of lightning upon a pyed bullock. A very singular effect of lightning is mentioned in the 66th volume of the Philosophical Transactions, upon a pyed bullock. It happened in the county of Suffolk about the end of August 1774. The bullock was white and red; and the lightning stripped off the white hair leaving the red untouched. The following is a particular account of the matter. "In the evening of Sunday, the 28th of August, there was an appearance of a thunder-storm, but we heard no report. A gentleman who was riding near the marshes not far distant from this town (Lewes) saw two strong flashes of lightning, seemingly running along the ground of the marsh, at about nine o'clock in the evening. On Monday morning, when the servants of Mr Roger, a farmer at Swanborough, in the parish of Iford, went into the marsh to fetch the oxen to their work, they found one of them, a four-year-old steer, standing up to appearance much burnt, and so weak as to be scarce able to walk. The animal seemed to have been struck by lightning in a very extraordinary manner. He is of a white and red colour; the white in large marks, beginning at the rump bone, and running in various directions along both the sides; the belly is all white, and the whole head and horns white likewise. The lightning, with which he must have been undoubtedly struck, fell upon the rump bone, which is white, and distributed itself along the sides in such a manner as to take off all the hair from the white marks as low as the bottom of the ribs, but so as to leave a list of white hair, about half an inch broad, all round where it joined to the red, and not a single hair of the red appears to be touched. The whole belly is unhurt, but the end of the sheath of the penis has the hair taken off; it is also taken off from the dewlap: the horns and the curled hair on the forehead are uninjured; but

the hair is taken off from the sides of the face, from the flat part of the jaw-bones, and from the front of the face in stripes. There are a few white marks on the side and neck, which are surrounded with red; and the hair is taken off from them, leaving half an inch of white adjoining to the red. The farmer anointed the ox with oil for a fortnight; the animal purged very much at first, and was greatly reduced in flesh, but is now recovering."

In another account of this accident, the author supposes that the bullock had been lying down at the time he was struck; which shows the reason that the under parts were not touched. "The lightning, conducted by the white hair, from the top of the back down the sides, came to the ground at the place where the white hair was left entire."

The author of this account says, that he inquired of a Mr Tooth a farmer, whether he ever knew of a similar accident; and that he told him "the circumstance was not new to him; that he had seen a great many pyed bullocks struck by lightning in the same manner as this; that the texture of the skin under the white hair was always destroyed, though looking fair at first; but after a while it became sore, throwing out a putrid matter in pustules, like the small-pox with us, which in time falls off, when the hair grows again, and the bullocks receive no farther injury;" which was the case with the bullock in question. In a subsequent letter, however, the very same author informs us, that he had inquired of Mr Tooth "whether he ever saw a stroke of lightning actually fall upon a pyed bullock, so as to destroy the white hair, and show evident marks of burning, leaving the red hair uninjured? He said he never did; nor did he recollect any one that had. He gave an account, however, of a pyed horse, belonging to himself, which had been struck dead by lightning in the night-time." The explosion was so violent, that Mr Tooth imagined his house had been struck, and therefore immediately got up. On going into the stable he found the horse almost dead to appearance, though it kept on its legs near half an hour before it expired. The horse was pyed white on the shoulder and greatest part of the head; viz. the forehead and nose, where the greatest force of the stroke came. "The hair was not burnt nor discoloured, only so loosened at the root, that it came off with the least touch. And this is the case, according to Mr Tooth's observation, with all that he has seen or heard of; viz. the hair is never burnt, but the skin always affected as above mentioned. In the horse, all the blood in the veins under the white parts of the head was quite stagnated, though he could perceive it to flow in other parts as usual; and the skin, together with one side of the tongue, was parched and dried up to a greater degree than he had ever seen before."

Another instance is mentioned of this extraordinary effect of lightning upon a bullock, in which even the small red spots on the sides were unaffected; and in this, as well as the former, the white hair on the under part of the belly, and on the legs, was left untouched.

All these, however, are to be considered as the more unusual phenomena of lightning; its common mode of action being entirely similar to that of a charged Leyden vial, where the electric matter discharges

Lightning.

itself from a substance positively electrified to one that is negatively so. The identity of electric matter and lightning seems now, indeed, to be well established, that there is not the least foundation for seeking any other solution of the phenomena of lightning, than what may be obtained by comparing them with those of our electrical experiments. The different forms of the flashes are all exemplified in those of electrical sparks. Where the quantity of electricity is small, and consequently incapable of striking at any considerable distance, the spark appears straight, without any curvature or angular appearance: but where the electricity is very strong, and of consequence capable of striking an object at a pretty considerable distance, it assumes a crooked or zig-zag form. This is always the case with Mr Nairn's very powerful machines, the conductors of which are six feet in length and one foot in diameter. Sparks may be taken from them at the distance of 16, 17, or even 20 inches; and all of these put on the angular zig-zag form of lightning.

Why it assumes a zig-zag form.

The reason of this appearance, both in these sparks and in the lightning, is, that the more fluid electric matter hath to pass through the denser and less fluid atmosphere with great rapidity; and in fact, this is the way in which all the more fluid substances pass through those that are less so, at least when their velocity becomes considerable. If bubbles of air or steam pass very gently up through water, their course from the bottom to the top of the vessel will differ very little, if at all, from a straight line; but when they are impelled by a considerable force, as in air blown from a bellows, or the bubbles of steam which arise in boiling water, their course is then marked by waved and crooked lines, and the deflection of the bubbles to the right or left will be precisely in proportion to their ascending velocity, and to the weight of the water by which they are resisted.

In the case of air blown through water, however, or steam ascending from the bottom of a vessel of boiling water, though the course of the bubbles is waved and crooked, we never observe it to be angular as in lightning. The reason of this is, that there is no proportion between the capacity of the air for yielding to the impetus of lightning, and the velocity with which the latter is moved. From Mr Robins's experiments in gunnery, it appears, that the air cannot yield with a velocity much greater than 1200 feet in a second, and that all projectiles moving with a greater degree of velocity meet with a violent resistance. But if we suppose lightning to move only with one half the velocity of light, that is, near 100,000 miles in a second, or even with that of 1000 miles in a minute, which most probably is the case*, its motion in the fluid atmosphere will meet with a resistance very little inferior to what air would meet with in passing through the most solid bodies. The smallest difference of the resistance of the atmosphere on either side, must determine the lightning to that side; and in its passage to that new place where the resistance is less, it must pass on in a straight line, making an angle with its former course, because the atmosphere is altogether incapable of yielding with such rapidity as the electric matter requires, and therefore resists like a solid rock. 'The case is otherwise in the former examples: for tho' a small difference in the resistance forces the bubbles of

* See Fireball.

air or steam to deviate from side to side, yet there is always a considerable proportion between the capacity of water for yielding, and that force by which the bubbles urge it to yield; so that though it does make a resistance sufficient to prevent the bubbles from moving in a straight line, yet it also perceptibly yields at all times, and therefore the tract of the bubbles is formed by a number of curves and not angles.

Hence we may understand the reason why the zig-zag kind of lightning is so dangerous, namely, because it cause it must overcome a very violent resistance of the atmosphere; and wherever that resistance is in the smallest degree lessened, there it will undoubtedly strike, and at a very considerable distance too. It is otherwise with that kind which appears in flashes of no determinate form. The electric matter of which these are composed, is evidently dissipated in the air by some conducting substances which are present there; and of consequence, though a man, or other conducting body, happened to be very near such a flash, he would not be struck or materially injured by it, though a zig-zag flash, in such circumstances, would have probably discharged its whole force upon him.

The most destructive kind of lightning, however, is that which assumes the form of balls. These are produced by an exceeding great power of electricity gradually accumulated till the resistance of the atmosphere is no longer able to confine it. In general, the lightning breaks out from the electrified cloud by means of the approach of some conducting substance; either a cloud, or some terrestrial substance: but the fire-balls seem to be formed, not because there is any substance at hand to attract the electric matter from the cloud, but because the electricity is accumulated in such quantity that the cloud itself can no longer contain it. Hence such balls fly off slowly, and have no particular destination. Their appearance indicates a prodigious commotion and accumulation of electricity in the atmosphere, without a proportionable disposition in the earth to receive it. This disposition, however, we know, is perpetually altered by a thousand circumstances, and the place which first becomes most capable of admitting electricity will certainly receive a fire-ball. Hence this kind of lightning has been known to move slowly backwards and forwards in the air for a considerable space of time, and then suddenly to fall on one or more houses, according to their being more or less affected with an electricity opposite to that of the ball at the time. It will also run along the ground, break into several parts, and produce several explosions at the same time.

It is very difficult to imitate lightning of this kind in our electrical experiments. The only cases in which it hath been done in any degree are those in which Dr Priestley made the explosion of a battery pass for a considerable way over the surface of raw flesh, water, &c. and in Mr Arden's experiment, when a fire-ball ascended to the top of an electrified jar, and burst it with a violent explosion. See ELECTRICITY n° 89, &c. In these cases, if, while the electric flash passed over the surface of the flesh, it had been possible to interrupt the metallic circuit by taking away the chain, the electric matter discharged from the battery would have been precisely in the situation of one of the fireballs.

Why such lightning is very dangerous.

Why lightning assumes the form of balls.

Lightning. balls above-mentioned; *i. e.* it would have been at a loss for a conductor. The negative side of the battery was the place of its destination; but to that it would not have easily got, because of the great quantity of atmosphere which lay in its way, and the incapacity of the neighbouring bodies to receive it. But, while the electric matter was thus stationary for want of a conductor, if any person standing near, or touching the negative side of the battery, presented a finger to that seemingly inoffensive luminous body, he would instantly be struck very violently; because a free communication being now made by means of his body, the powers by which the electric fluid is impelled from one place to another would instantly urge it upon him. But if we suppose a person, who hath no communication with the battery, to present his finger to the same body, he may perhaps receive a slight spark from it; but not a shock of any consequence, because there is not a perfect communication by means of his body with the place to which the electric fire is destined.

Phenomena of lightning in general accounted for. Hence we may account for the seemingly capricious nature of lightning of all kinds, but especially of that kind which appears in the form of balls. Sometimes it will strike trees, high houses, steeples, and towers, without touching cottages, men, or other animals, who are in the neighbourhood. In such cases, people would be apt to say that the neighbourhood of these higher objects *preferred* the others from the stroke; but with little reason, since low houses, men walking in the fields, cattle, nay the surface of the earth itself, have all been struck, while high trees and steeples in the neighbourhood have not been touched. In like manner, fire-balls have passed very near certain persons without hurting them, while they have, as it were, gone considerably out of their way to kill others. The reason of all this is, that in thunder-storms there is constantly a certain zone of earth considerably under the surface, which the lightning desires (if we may use the expression) to strike, because it hath an electricity opposite to that of the lightning itself. Those objects, therefore, which form the most perfect conductors between the electrified clouds and that zone of earth, will be struck by the lightning, whether they are high or low; and because we know not the conducting quality of the different terrestrial substances, the superstitious are apt to ascribe strokes of lightning to the divine vengeance against particular persons, whereas it is certain that this fluid, as well as others, acts according to invariable rules from which it is never known to depart.

Lightning, in the time of severe thunder-forms, is supposed to proceed from the earth, as well as from the clouds: but this fact hath never been well ascertained, and indeed from the nature of the thing it seems very difficult to be ascertained; for the motion of the electric fluid is so very quick, that it is altogether impossible to determine, by means of our senses, whether it goes from the earth or comes to it. In fact, there are in this country many thunder-forms in which it doth not appear that the lightning touches any part of the earth, and consequently can neither go to it nor come out from it. In these cases, it flashes either from an electrified cloud to one endowed with

an opposite electricity, or merely into those parts of **Lightning.** the atmosphere which are ready to receive it. But if not only the clouds, but the atmosphere all the way betwixt them and the earth, and likewise for a considerable space above the clouds, are electrified one way, the earth must then be struck. The reason of this will appear from a consideration of the principles laid down under the article **ELECTRICITY**, sect. vi. It there appears, that the electric fluid is altogether incapable either of *accumulation* or *diminution* in quantity in any particular part of space. What we call *electricity* is only the motion of this fluid made perceptible to our senses. Positive electricity is when the current of electric matter is directed from the electrified body. Negative electricity is when the current is directed towards it. Let us now suppose, that a positively electrified cloud is formed over a certain part of the earth's surface. The electric matter flows out from it first into the atmosphere all round; and while it is doing so, the atmosphere is negatively electrified. In proportion, however, as the electric current pervades greater and greater portions of the atmospheric space, the greater is the resistance to its motion, till at last the air becomes positively electrified as well as the cloud, and then both act together as one body. The surface of the earth then begins to be affected, and it silently receives the electric matter by means of the trees, grass, &c. till at last it becomes positively electrified also, and begins to send off a current of electricity from the surface downwards. The causes which at first produced the electricity of the clouds (and which are treated of under the article **THUNDER**), still continuing to act, the power of the electric current becomes inconceivably great. The danger of the thunder-storm now begins; for as the force of the lightning is directed to some place below the surface of the earth, it will certainly dart towards that place, and slatter every thing to pieces which resists its passage. The benefit of conducting-rods will now also be evident: ¹¹ Use of conducting rods. for we are sure that the electric matter will in all cases take the way where it meets with the least resistance; and this is through the substance, or rather over the surface, of metals. In such a case, therefore, if there happen to be a house furnished with a conductor directly below the cloud, and at the same time a zone of negatively electrified earth not very far below the foundation of the house, the conductor will almost certainly be struck, but the building will be unhurt. If the house wants a conductor, the lightning will nevertheless strike in the same place, in order to get at the negatively electrified zone above mentioned; but the building will now be damaged, because the materials of it cannot readily conduct the electric fluid.

We will now be able to enter into the dispute, **Whether** the preference is due to knobbed or pointed conductors for preferring buildings from strokes of lightning? Ever since the discovery of the identity of electricity and lightning, it hath been allowed by all parties, that conductors of some kind are in a manner essentially necessary for the safety of buildings in those countries where thunder-forms are very frequent. The principle on which they act hath been already explained; namely, that the electric fluid, when impelled by any power, always goes to that place where

Lightning. it meets with the least resistance, as all other fluids also do. As metals, therefore, are found to give the least resistance to its passage, it will always choose to run along a metaline rod, in preference to a passage of any other kind. We must, however, carefully consider a circumstance which seems to have been too much overlooked by electricians in their reasonings concerning the effects of thunder-rods; namely, That lightning, or electricity, never strikes a body, merely for the sake of the body itself, but only because by means of that body it can readily arrive at the place of its destination. When a quantity of electricity is collected from the earth, by means of an electric machine, a body communicating with the earth will receive a strong spark from the prime conductor. The body receives this spark, not because it is itself capable of containing all the electricity of the conductor and cylinder, but because the natural situation of the fluid being disturbed by the motion of the machine, a stream of it is cast off from the earth. The natural powers, therefore, make an effort to supply what is thus drained off from the earth; and as the individual quantity which comes out is most proper for supplying the deficiency, as not being employed in any natural purpose, there is always an effort made for returning it to the earth. No sooner, then, is a conducting body, communicating with the earth, presented to the electrical machine, than the whole effort of the electricity is directed against that body, not merely because it is a conductor, but because it leads to the place where the fluid is directed by the natural powers by which it is governed, and at which it would find other means to arrive, though that body were not to be presented. That this is the case, we may very easily satisfy ourselves, by presenting the very same conducting substance in an insulated state to the prime conductor of the machine; for then we shall find, that only a very small spark will be produced. In like manner, when lightning strikes a tree, a house, or a thunder-rod, it is not because these objects are high, or in the neighbourhood of the cloud; but because they communicate with some place below the surface of the ground, against which the impetus of the lightning is directed; and at that place the lightning would certainly arrive, though none of the above-mentioned objects had been interposed.

The fallacy of that kind of reasoning generally employed concerning the use of thunder-rods, will now be sufficiently apparent. Because a point presented to an electrified body in our experiments, always draws off the electricity in a silent manner; therefore Dr Franklin and his followers have concluded, that a pointed conductor will do the same thing to a thunder-cloud, and thus effectually prevent any kind of danger from a stroke of lightning. Their reasoning on this subject, they think, is confirmed by the following fact among many others. "Dr Franklin's house at Philadelphia was furnished with a rod extending nine feet above the top of the chimney. To this rod was connected a wire of the thickness of a goose-quill, which descended through the wall of the stair-case; where an interruption was made, so that the ends of the wire, to each of which a little bell was fixed, were distant from each other about six inches; an insulated brass

ball hanging between the two bells. The author was Lightning. one night waked by loud cracks, proceeding from his apparatus in the stair-case. He perceived, that the brass ball, instead of vibrating as usual between the bells, was repelled and kept at a distance from both; while the fire sometimes passed in very large quick cracks directly from bell to bell; and sometimes in a continued dense white stream, seemingly as large as his finger; by means of which the whole stair-case was enlightened, as with sun-shine, so that he could see to pick up a pin. - From the apparent quantity of electric matter of which the cloud was thus evidently robbed, by means of the pointed rod (and of which a blunt conductor would not have deprived it), the author conceives, that a number of such conductors must considerably lessen the quantity of electric fluid contained in any approaching cloud, before it comes so near as to deliver its contents in a general stroke."

For this very reason, Mr Benjamin Wilson and his followers, who constitute the opposite party, have determined that the use of pointed conductors is utterly unsafe. They say, that in violent thunder storms the whole atmosphere is full of electricity; and that attempts to exhaust the vast quantity there collected, are like attempting to clear away an inundation with a shovel, or to exhaust the atmosphere with a pair of bellows. They maintain, that though pointed bodies will effectually prevent the accumulation of electricity in any substance; yet if a non-electrified body is interposed between a point and the conductor of an electrical machine, the point will be struck at the same moment with the non-electrified body, and at a much greater distance than that at which a knob would be struck. They affirm also, that, by means of this silent solicitation of the lightning, inflammable bodies, such as gun-powder, tinder, and Kunckel's phosphorus, may be set on fire; and for these last facts they bring decisive experiments. From all this, say they, it is evident that the use of pointed conductors is unsafe. They solicit a discharge to the place where they are; and as they are unable to conduct the whole electricity in the atmosphere, it is impossible for us to know whether the discharge they solicit may not be too great for our conductor to bear; and consequently all the mischiefs arising from thunder-forms may be expected, with this additional and mortifying circumstance, that this very conductor hath probably solicited the fatal stroke, when without it the cloud might have passed harmless over our heads without striking at all.

Here the reasoning of both parties seems equally wrong. They both proceed on this erroneous principle, That in thunder-forms the conductor will always solicit a discharge, or that at such times all the elevated objects on the surface of the earth are drawing off the electricity of the atmosphere. But this cannot be the case, unless the electricity of the earth and of the atmosphere is of a different kind. Now, it is demonstrable, that until this difference between the electricity of the atmosphere and of the surface of the earth ceases, there cannot be a thunder-form. When the atmosphere begins to be electrified either positively or negatively, the earth, by means of the inequalities and moisture of its surface, but especially by the vegetables which grow

Lightning grow upon it, absorbs that electricity, and quickly becomes electrified in the same manner with the atmosphere. This absorption, however, ceases in a very short time, because it cannot be continued without setting in motion the whole of the electric matter contained in the earth itself. Alternate zones of positive and negative electricity will then begin to take place below the surface of the earth, for the reasons mentioned under the article ELECTRICITY, sect. vi. § 9. Between the atmosphere and one of these zones, the stroke of the lightning always will be. Thus supposing the atmosphere is positively electrified, the surface of the earth will, by means of trees, &c. quickly become positively electrified also; we shall suppose to the depth of 10 feet. The electricity cannot penetrate farther on account of the resistance of the electric matter in the bowels of the earth. At the depth of 10 feet from the surface, therefore, a zone of negatively electrified earth begins, and to this zone the electricity of the atmosphere is attracted; but to this it cannot get, without breaking through the positively electrified zone which lies uppermost, and flustering to pieces every bad conductor which comes in its way. We are very sure, therefore, that in whatever places the outer-zone of positively electrified earth is thinnest, there the lightning will strike, whether a conductor happens to be present or not. If there is a conductor, either knobbed or sharp-pointed, the lightning will indeed infallibly strike it; but it would also have struck a house situated on that spot, without any conductor; and though the house had not been there, it would have struck the surface of the ground itself.—Again, if we suppose the house with its conductor to stand on a part of the ground where the positively electrified zone is very thick, the conductor will neither silently draw off the electricity, nor will the lightning strike it, though perhaps it may strike a much lower object, or even the surface of the ground itself, at no great distance; the reason of which undoubtedly is, that there the zone of positively electrified earth is thinner than where the conductor was.

We must also observe, that the Franklinians make their pointed conductors to be of too great consequence. To the houses on which they are fixed, no doubt, their importance is very great: but in exhausting a thunder-cloud of its electricity, their use must appear trifling; and to insist on it, ridiculous. Innumerable objects, as trees, grass, &c. are all conspiring to draw off the electricity, as well as the conductor, if it could be drawn off; but of effecting this there is an impossibility, because they have the same kind of electricity with the clouds themselves. The conductor hath not even the power of *attracting* the lightning a few feet out of the direction which it would choose of itself. Of this we have a most remarkable and decisive instance in what has happened to the magazine at Purfleet in Essex, on May 15. 1777. That house was furnished with a pointed conductor, raised above the highest part of the building; nevertheless, about six in the evening of the abovementioned day, a flash of lightning struck an iron cramp in the corner of the wall considerably lower than the top of the conductor, and only 46 feet in a sloping line distant from the point.—This produced a long dispute with Mr Wilson concerning the propriety of using pointed conductors; and, by the

favour of his majesty, he was enabled to construct a Lightning more magnificent electrical apparatus than any private person could be supposed to erect at his own expense, and of which some account is given under the article ELECTRICITY, n° 83. The only new experiments, however, which this apparatus produced, were the firing of gunpowder by the electric *aura* as it is called; and a particularly violent shock which a person received when he held a small pointed wire in his hand, upon which the conductor was discharged. We must observe, that the electrified surface of the conductor was 620 feet; and we can have but little idea of the strength of sparks from a conductor of this magnitude, supposing it properly electrified. Six turns of the wheel made the discharge felt through the whole body like the strong shock of a Leyden vial; and nobody chose to make the experiment when the conductor had received a higher charge. A very strong shock was felt, as already observed, when this conductor was discharged upon a pointed wire held in a person's hand, even though the wire communicated with the earth; which was not felt, or but very little, when a knobbed wire was made use of. To account for this difference may, perhaps, puzzle electricians; but with regard to the use of blunt or pointed thunder-rods, both experiments seem quite inconclusive. Though a very great quantity of electric matter silently drawn off will fire gunpowder, this only proves that a pointed conductor ought not to pass through a barrel of gunpowder; and if a person holding a pointed wire in his hand received a strong shock from Mr Wilson's great conductor, it can thence only be inferred, that in the time of thunder nobody ought to hold the conductor in their hands; both which precautions common sense would dictate without any experiment. From the accident at Purfleet, however, the disputants on both sides ought to have seen, that, with regard to lightning, neither points nor knobs can *attract*. Mr Wilson surely had no reason to condemn the pointed conductor for *soliciting* the flash of lightning, seeing it did not strike the point of the conductor, but a blunt cramp of iron; neither have the Franklinians any reason to boast of its effect in *silently drawing off* the electric matter, since all its powers were neither able to prevent the flash, nor to turn it 46 feet out of its way. The matter of fact is, the lightning was determined to enter the earth at the place where the board-house stands, or near it. The conductor fixed on the house offered the easiest communication: but 46 feet of air intervening between the point of the conductor and the place of explosion, the resistance was less through the blunt cramp of iron, and a few bricks moistened with rain-water, to the side of the metalline conductor, than through the 46 feet of air to its point; for the former was the way in which the lightning actually passed.

Mr Wilson and his followers seem also mistaken in supposing that a pointed conductor can solicit a greater discharge than what would otherwise happen. Allowing the quantity of electricity in the atmosphere during the time of a thunder-storm to be as great as they please to suppose; nevertheless, it is impossible that the air can part with all its electricity at once, on account of the difficulty with which the fluid moves in it. A pointed conductor, therefore, if it does any thing at all, can only solicit the partial discharge which

^{Lightning.} which is to be made at any rate: and if none were to be made though the conductor was absent, its presence will not be able to effect any.

An objection to the use of conductors, whether blunt or pointed, may be drawn from the accident which happened to the poor-house at Heckingham, which was struck by lightning though furnished with eight pointed conductors; but from an accurate consideration of the manner in which the conductors were situated, it appears, that there was not a possibility of their preventing any stroke. See Philosophical Transactions, Vol. LXXII. p. 361.

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Lord Ma-
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In a late publication on the subject of electricity by Lord Mahon, we find a new kind of lightning made mention of, which he is of opinion may give a fatal stroke, even though the main explosion be at a considerable distance; a mile, for instance, or more. This he calls the *electrical returning stroke*; and exemplifies it in the following manner, from some experiments made with a very powerful electrical machine, the prime conductor of which (six feet long, by one foot diameter) would generally, when the weather was favourable, strike into a brass ball connected with the earth, to the distance of 18 inches or more. In the following account, this brass ball, which we shall call *A*, is supposed to be constantly placed at the *striking distance*; so that the prime conductor, the instant that it becomes fully charged, explodes into it.

Another large conductor, which we shall call the *second conductor*, is suspended, in a perfectly insulated state, farther from the prime conductor than the *striking distance*, but within its *electrical atmosphere*; at the distance of *six feet*, for instance. A person standing on an insulating stool touches this *second conductor* very lightly with a finger of his right hand; while, with a finger of his left hand, he communicates with the earth, by touching very lightly a second brass ball fixed at the top of a metallic stand, on the floor, and which we shall call *B*.

While the prime conductor is receiving its electricity, sparks pass (at least if the distance between the two conductors is not too great) from the second conductor to the insulated person's right hand; while similar and simultaneous sparks pass out from the finger of his left hand into the second metallic ball *B*, communicating with the earth. These sparks are part of the *natural quantity* of electric matter belonging to the second conductor, and to the insulated person; driven from them into the earth, through the ball *B*, and its stand, by the elastic pressure or action of the electrical atmosphere of the prime conductor. The second conductor and the insulated person are hereby reduced to a *negative state*.

At length, however, the prime conductor, having acquired its *full charge*, suddenly strikes into the ball *A*, of the first metallic stand, placed for that purpose at the *striking distance* of 17 or 18 inches. The explosion being made, and the prime conductor suddenly robbed of its electric atmosphere, its pressure or action on the second conductor, and on the insulated person, as suddenly ceases; and the latter instantly feels a smart *returning stroke*, though he has no direct or visible communication (except by the floor) either with the *striking* or *struck* body, and is placed at the distance of *five or six feet* from both of them. This returning stroke

is evidently occasioned by the sudden *re-entrance* of the *Lightning*, to electric fire *naturally* belonging to his body and to the second conductor, which had before been expelled from them by the action of the charged prime conductor upon them; and which returns to its former place the instant that action or elastic pressure ceases. The author shows, that there can be no reason to suppose that the electrical discharge from the prime conductor should in this experiment *divide itself* at the instant of the explosion, and go different ways, so as to strike the second conductor and insulated person in this manner, and at such a distance from it.

When the second conductor and the insulated person are placed in the *densest* part of the electrical atmosphere of the prime conductor, or *just beyond* the striking distance, the effects are still more considerable; the *returning stroke* being extremely severe and pungent, and appearing considerably sharper than even the *main stroke* itself, received directly from the prime conductor.

This circumstance the author alleges as an unanswerable proof that the effect which he calls the *returning stroke*, was not produced by the *main stroke* being any wise *divided* at the time of the explosion, since no effect can ever be greater than the *cause* by which it is *immediately* produced.—Having taken the *returning stroke* eight or ten times one morning, he felt a considerable degree of pain across his chest during the whole evening, and a disagreeable sensation in his arms and wrists all the next day.

We come now to the application of this experiment, and of the doctrine deduced from it, to what passes in *natural electricity*, or during a thunder-storm; in which there is reason to expect similar effects, but on a larger scale:—a scale so large indeed, according to the author's representation, that persons and animals may be destroyed, and particular parts of buildings may be considerably damaged, by an electrical *returning stroke*, occasioned even by some *very distant explosion* from a thunder-cloud:—possibly at the distance of a mile or more.

It is certainly easy to conceive, that a charged extensive thunder-cloud must be productive of effects similar to those produced by the author's prime conductor. Like it, while it continues charged, it will, by the *superinduced elastic electrical pressure* of its atmosphere, to use the author's own expression, drive into the earth a part of the electric fluid *naturally* belonging to the bodies which are within the reach of its *widely extended atmosphere*; and which will therefore become *negatively electrical*. This portion too of their electric fire, as in the artificial experiments, will, on the explosion of the cloud, at a *distance*, and the cessation of its action upon them, suddenly *return* to them; so as to produce an equilibrium, and restore them to their *natural state*.

To this theory, the authors of the Monthly Review ¹⁴ Answered have given the following answer: "We cannot, how-by the Re-
viewers. ever, agree with the ingenious author, with respect to the *greatness* of the effects, or of the danger to be apprehended from, the *returning stroke* in this case; as we think his estimate is grounded on an erroneous foundation.—Since (says he) the density of the electrical atmosphere of a *thunder-cloud* is so *immense*, when compared to the electrical density of the electrical atmosphere of any *prime conductor*, charged by means of any electri-
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Lightning—*cal apparatus whatsoever*; and since a *returning stroke*, when produced by the sudden removal of even the *weak* elastic electrical pressure of the electrical atmosphere of a charged *prime conductor*, may be extremely *strong*, as we have seen above; it is *mathematically evident*, that, when a *returning stroke* comes to be produced by the sudden removal of the very strong elastic electrical pressure of the electrical atmosphere of a thunder-cloud powerfully charged; the strength of such a *returning stroke* must be enormous.*

"If indeed the quantity of electric fluid *naturally* contained in the body of a man, for instance, were immense, or indefinite, the author's estimate between the effects producible by a cloud, and those caused by a prime conductor, might be admitted. But surely an electrified cloud,—how great soever may be its extent, and the height of its charge when compared with the extent and charge of a prime conductor—cannot expel from a man's body (or any other body) *more* than the *natural* quantity of electricity which it contains. On the sudden removal, therefore, of the pressure by which this natural quantity had been expelled, in consequence of the explosion of the cloud into the earth; *no more* (at the utmost) than his *whole natural stock* of electricity can re-enter his body (c). But we have no reason to suppose that this quantity is so great, as that its sudden re-entrance into his body should destroy or even injure him.

"In the experiment above described, the insulated person receives into his body, at the instant of the *returning stroke*, not only all that portion of his own natural electric fire which had been expelled from it; but likewise transmits through it, at the same instant, in consequence of his peculiar situation, all the electric fire of which the large second conductor had been robbed; and which must necessarily re-pass through his body, to arrive at that conductor. To render the case somewhat parallel, in *natural electricity*, the man's body must be so peculiarly circumstanced, supposing him to be in a house, that the electric matter which has been expelled from the house into the earth, by the pressure of an extensive thunder-cloud, could not return back into the building, on the explosion of the cloud at a distance, without passing through his body: a case not likely to happen, unless the house were insulated (like the second conductor in the preceding experiment), and his body became the channel through which alone the house could have its electric matter restored to it; it appears much more probable that the electric matter returns to the house through the *same channels* by which it before insensibly passed out, and with equal silence, though more suddenly.

"In the case of a man who is abroad, and in an *open field*, during the time of an explosion:—as he is unconnected with other masses of matter *above him*, no more than the precise quantity of electric fire, which had been before expelled from his body, will *suddenly* return into it at the instant of a distant explosion: and that this quantity is not usually very large, may be inferred from many considerations.

"When a person standing on the ground holds a pair of Mr Canton's balls in his hand, while a highly charged thunder-cloud is suspended over his head; the angle made by the balls indicates the *electrical state* of that person, or the quantity of *natural electricity* of which his body is at that time deprived, by the action of the (*positively*) charged cloud hanging over him. But we have never seen the repulsion of the balls so considerable, as to furnish any just apprehensions that the return of his natural electric matter, however sudden, could be attended with injury to him: nor would he be sensible of any commotion on the balls suddenly coming together; though a spark might undoubtedly be perceived, at that instant, were he insulated, and placed in the same manner with the author when he tried the above-related experiment.

"The author nevertheless observes, that 'there have been instances of persons who have been killed by *natural electricity*, having been found with their *shoes torn*, and with their *feet* damaged by the electrical fire; but who have not had, over their whole body, any other apparent marks of having been struck with lightning.' He adds, 'if a man walking out of doors were to be killed by a *returning stroke*, the electrical fire would rush into that man's body through his *feet*, and his feet only; which would not be the case, were he to be killed by any *main stroke* of explosion, either positive or negative.'

"It would be no difficult task, we think, to account for these appearances in a different manner; were all the circumstances attending the case minutely ascertained: but without interrogating the *dead* on this subject, we may more satisfactorily appeal to the experience of the *living* (v), to show, that though the *returning stroke* must take place, in all thunder-forms, in some degree or other; yet it is not of that alarming magnitude which the author ascribes to it. If, in any particular thunder-form, a man in the open fields could be killed, at the instant of a distant explosion, merely by the return of his *own* electric fire, which had before been driven out of his body; surely numerous observations of persons who had experienced the *returning stroke*, in *slighter* degrees, would be familiar; and scarce a great thunder-form must have occurred, in which

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(c) "We suppose the person not to be so situated, that the *returning fire* of other bodies must necessarily pass through his body."

(d) "The author does indeed produce a *living* evidence, in the case of a person at Vienna, who, he has been credibly informed, received an electrical shock, by having held one hand accidentally in contact with an interrupted metallic conducting rod, at the instant that a thunder-cloud exploded at the distance, as was conjectured, of above half an English mile. He likewise observes, that a 'very strong, bright, and sudden stroke' (or spark) of electrical fire has been seen, by several electricians, to pass in the interval, or interruption, purposely left in the conducting rod of a house at the instant of a distant explosion; and 'when it was fully proved, by the sharp point of the conductor not being melted, or even tinged,' that the conductor itself had not been struck.—These observations, however, do not by any means prove the magnitude or danger of the *returning stroke*, but merely its *existence*; which we do not question."

Lightning. one person or another must not, at the instant of an explosion, have felt the effects of the *returning stroke*, in *some degree or other*—from that of a violent *concussion*, to that of a slight and almost imperceptible *puffation*. But no observations of this kind are known to us; nor have we ever heard of any person's experiencing any kind of electrical commotion in a thunder-storm, except such as have either been directly struck, or have happened to be in the *very near neighbourhood* of the spot where the explosion took place.

"The author has been aware of this objection, which he proposes, and endeavours to remove: but his answer to it amounts to little more than what has been already quoted from him; that is, to a simple estimate of the enormous difference between the electrical density, or the *elastic electrical pressure*, of the atmosphere of an extensive *thunder cloud*, and that of a charged *prime conductor*. We have already observed, that this is not the proper method of estimating their different effects, when these two causes, how unequal soever in power, are considered as exerting that power on bodies containing a *limited* and comparatively *small*, quantity of electric matter.

"We have been induced to discuss this subject thus particularly, with a view to quiet the minds of the timorous; as the author's extension of his principles, respecting the returning stroke in *artificial electricity*, to what passes in *natural electricity*, holds out a new, and, in our opinion, groundless subject of terror to those who, in the midst of their apprehensions, have hitherto only dreaded the effects of a thunder-storm when it made near approaches to them; but who, if this doctrine were believed, would never think themselves in security while a thunder-cloud appeared in sight, unless sheltered in a house furnished with proper conductors:—for we should not omit to remark, that a subsequent observation tends to diminish their fears, by showing that *high* and *pointed* conductors tend to secure both persons and buildings against the various effects of any *returning stroke* whatever, as well as of the *main stroke*."

A late melancholy accident which happened in Scotland has afforded Lord Mahon an opportunity of bringing additional arguments in favour of his system. An account of this accident is given by Patrick Brydone, Esq; F. R. S. in the 77th volume of the Philosophical Transactions. It happened on the 19th of July 1785, near Coldstream on the Tweed. The morning was fine, with the thermometer at 68°; but about eleven o'clock the sky became obscured with clouds in the south-east: and betwixt twelve and one a storm of thunder and lightning came on. This storm was at a considerable distance from Mr Brydone's house, the intervals between the flash and crack being from 25 to 30 seconds, so that the place of explosion must have been betwixt five and six miles off: but while our author was observing the progress of the storm, he was suddenly surprised with a loud report, neither preceded nor accompanied by any flash of lightning, which resembled the explosion of a great number of muskets, in such quick succession, that the ear could scarcely discriminate the sounds. On this the thunder and lightning instantly ceased, the clouds began to separate, and the sky soon recovered its serenity. In a little time Mr Brydone was informed, that

N° 182.

a man with two horses had been killed by the *thunder*. **Lightning.** der; and, on running out to the place, our author found the two horses lying on the spot where they had been first struck, and still yoked to the cart. As the body of the man who was killed had been carried off, Mr Brydone himself had not an opportunity of examining it, but was informed by Mr Bell, minister of Coldstream, who saw it, that the skin of the right thigh was much burnt and shrivelled; that there were many marks of the same kind all over the body, but none on the legs: his clothes, particularly his shirt, had a strong smell of burning; and there was a zig-zag line of about an inch and a quarter broad, extending from the chin to the right thigh, and which seemed to have followed the direction of the buttons of his waistcoat. The body was buried in two days without any appearance of putrefaction.

Mr Brydone was informed by another person who accompanied him that was killed, of the particular circumstances. They were both driving carts loaded with coals; and James Lauder, the person who was killed, had the charge of the foremost cart, and was sitting on the fore part of it. They had crossed the Tweed a few minutes before at a deep ford, and had almost gained the highest part of an ascent of about 65 or 70 feet above the bed of the river, when he was stunned with the report above mentioned, and saw his companion with the horses and cart fall down. On running up to him, he found him quite dead, with his face livid, his clothes torn in pieces, and a great smell of burning about him. At the time of the explosion he was but about 24 yards distant from Lauder's cart, and had him full in view when he fell, but felt no shock, neither did he perceive any flash or appearance of fire. At the time of the explosion his horses turned round, and broke their harness. The horses had fallen on their left side, and their legs had made a deep impression on the dust; which, on lifting them up, showed the exact form of each leg, so that every principle of life seemed to have been extinguished at once, without the least struggle or convulsive motion. The hair was singed over the greatest part of their bodies; but was most perceptible on their belly and legs. Their eyes were dull and opaque, as if they had been long dead, though Mr Brydone saw them in half an hour after the accident happened. The joints were all supple, and he could not observe that any of the bones were broken or dissolved, as is said to be sometimes the case with those who are killed by lightning. The left shaft of the cart was broken, and splinters had been thrown off in many places; particularly where the timber of the cart was connected by nails or cramps of iron. Many pieces of the coal were thrown to a considerable distance; and some of them had the appearance of being some time on a fire. Lauder's hat was torn into innumerable small pieces; and some part of his hair was strongly united to those which had composed the crown of it. About four feet and a half behind each wheel of the cart he observed a circular hole of about 20 inches diameter, the centre of which was exactly in the track of each wheel. The earth was torn up as if by violent blows of a pick-axe; and the small stones and dust were scattered on each side of the road. The tracks of the wheels were strongly marked in the dust, both before and behind these holes, but did not in the smallest

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Lightning. smallest degree appear on the spots themselves for upwards of a foot and a half. There were evident marks of fusion on the iron rings of the wheels; the surface of the iron, the whole breadth of the wheel, and for the length of about three inches, was become bluish, had lost its polish and smoothness, and was formed into drops which projected sensibly, and had a roundish form; but the wood did not appear any way injured by the heat which the iron must have conceived. To determine whether these were made by the explosion which had torn up the ground, the cart was pushed back on the same tracks which it had described on the road; and the marks of fusion were found exactly to correspond with the centres of the holes. They had made almost half a revolution after the explosion; which our author ascribes to the cart being pulled a little forward by the fall of the horses. Nothing remarkable was observed on the opposite part of the wheel. The broken ground had a smell something like that of ether; the soil itself was very dry and gravely.

The catastrophe was likewise observed by a shepherd, at the distance of about 200 or 300 yards from the spot. He said, that he was looking at the two carts going up the bank when he heard the report, and saw the foremost man and horses fall down; but observed no lightning, nor the least appearance of fire, only he saw the dust rise about the place. There had been several flashes of lightning before that from the south-east; whereas the accident happened to the north-west of the place where he stood. He was not sensible of any shock.

Our author next gives an account of several phenomena which happened the same day, and which were evidently connected with the explosion. A shepherd tending his flock in the neighbourhood, observed a lamb drop down; and said, that he felt at the same time as if fire had passed over his face, though the lightning and claps of thunder were at a considerable distance. He ran up to the creature immediately, but found it quite dead; on which he bled it with his knife, and the blood flowed freely. The earth was not torn up; nor did he observe any dust rise, though he was only a few yards distant. This happened about a quarter of an hour before Lauder was killed, and the place was only about 300 yards distant.

About an hour before the explosion, two men standing in the middle of the Tweed, fishing for salmon, were caught in a violent whirlwind, which felt sultry and hot, and almost prevented them from breathing. They could not reach the bank without much difficulty and fatigue; but the whirlwind lasted only a very short time, and was succeeded by a perfect calm.

A woman making hay, near the banks of the river, fell suddenly to the ground, and called out that she had received a violent blow on the foot, and could not imagine from whence it came; and Mr Bell, the minister above mentioned, when walking in his garden, a little before the accident happened to Lauder, felt several times a tremor in the ground.

The conclusion drawn from these facts by Brydone is, that at the time of the explosion the equilibrium between the earth and the atmosphere seems to have been completely restored, as no more thunder was heard nor lightning observed; the clouds were dispelled, and the atmosphere resumed the most perfect tranquillity: "But how this vast quantity of electric matter (says he) could be discharged from the one ele-

ment to the other, without any appearance of fire, I shall not pretend to examine. From the whole it would appear, that the earth had acquired a great superabundance of electrical matter, which was every where endeavouring to fly off into the atmosphere. Perhaps it might be accounted for from the excessive dryness of the ground, and for many months the almost total want of rain, which is probably the agent that nature employs in preserving the equilibrium between the two elements."

Lord Malton, now Earl Stanhope, whose observations on this accident are published in the same volume, endeavours to establish the following positions as facts.

1. That the man and horses were not killed by any *direct main stroke of explosion* from a thunder-cloud either positively or negatively electrified.

2. They were not killed by any *transmitted main stroke* either positive or negative.

3. The mischief was not done by any *lateral explosion*. All these are evidently true, at least with respect to lightning at that time falling from the clouds; for all the lightning which had taken place before was at a great distance.

4. They were not suffocated by a sulphureous vapour or smell which frequently accompanies electricity. This could not account for the pieces of coal being thrown to a considerable distance all round the cart, and for the splinters of the wood which were thrown off from many parts of the cart.

5. It might be imagined by some that they were killed by the violent commotion of the atmosphere, occasioned by the vicinity of the electrical explosion, in a manner similar to the fatal wounds that sometimes have been known to have been given by the air having been suddenly displaced by a cannon-ball in its passage through the atmospherical fluid, though the cannon-ball itself had evidently neither struck the person wounded nor grazed his clothes. The dust that rose at the time of the explosion might be brought as an argument in favour of the opinion, that a sudden and violent commotion of the air did occasion the effects produced. But such an explanation would not account for the marks of fusion on the iron of the wheels, nor for the hair of the horses being singed, nor for the skin of Lauder's body having been burnt in several places.

6. From these different circumstances his Lordship is of opinion, that the effects proceeded from electricity; and that *no electrical fire did pass* immediately, either from the clouds into the cart, or from the cart into the clouds. From the circular holes in the ground, of about 20 inches diameter, the respective centres of which were exactly in the track of each wheel, and the corresponding marks of fusion in the iron of the wheels, it is evident that the electrical fire did pass from the earth to the cart, or from the cart to the earth, through that part of the iron of the wheels which was in contact with the ground. From the splinters which had been thrown off in many places, particularly where the timber was connected by nails or cramps of iron, and from various other effects mentioned in Mr Brydone's account, it is evident, that there must have been a great commotion in the electrical fluid in all, or at least in different parts of the cart, and in the bodies of the man and horses, although there was no lightning.

7. All these phenomena, his Lordship argues, may be explained in a satisfactory manner from the doctrine

17
Arguments
drawn by
Earl Stan-
hope in fa-
vour of his
system.

Lightning. already laid down concerning the returning stroke. Before entering upon the subject of the main explosion, however, he takes notice of the other phenomena already mentioned in Mr Brydones account.

With regard to the case of the lamb, his lordship is of opinion, that it belongs to the most simple class of returning strokes, *viz.* that which happens at a place where there is neither thunder nor lightning near; and that it may be produced by the sudden removal of the elastic electrical pressure of the electrical atmosphere of a single main cloud, as well as of an assemblage of clouds. It appears (says he) by Mr Brydones account, that the shepherd who saw the lamb fall, was near enough to it to feel, in a small degree, the electrical returning stroke at the same time that the lamb dropped down.—The blow which the woman received on the foot was unquestionably the returning stroke. When a person walking, or standing, out of doors, is knocked down or killed by the returning stroke, the electrical fire must rush in, or rush out, as the case may be, through that persons feet, and through them only; which would not be the case were the person to be killed by any main stroke of explosion either positive or negative.

8. In order to account for the manner in which the man and horses were killed, his lordship premises, that, according to Mr Brydones account, the cloud must have been many miles in length; inasmuch as just before the report, the lightning was at a considerable distance, *viz.* between five and six miles. The loud report resembled the firing of several muskets so close together, that the ear could scarcely separate the sounds, and was followed by no rumbling noise like the other claps. This indicates, that the explosion was not far distant, and likewise that it was not extremely near: for, if the explosion had been very near, the ear could not at all have separated the sounds.

¹⁸
Hypothesis
by which
he accounts
for the phe-
nomena.
9. Let us now suppose a cloud, eight, ten, or twelve miles in length to be extended over the earth, and let another cloud be situated betwixt that and the earth; let them also be supposed charged with the same kind of electricity, and both positive. Let us farther suppose the lower cloud to be near the earth, only a little beyond the striking distance; and the man, cart, and horses, to be situated under that part of the cloud which is next the earth, and to be exactly as described by Mr Brydone, *viz.* near the summit of an hill, and followed by another a little farther down; and let us suppose the two clouds to be near each other just over the place where the man and horses are: Let the remote end of the cloud approach the earth, and discharge its electricity into it. In this case the following effects will take place.

10. When the upper cloud discharges its electricity into the earth from the remote end, the lower cloud will discharge its electricity into the nearer end of the upper cloud, which is supposed to be directly over the place of the cart and horses, or nearly so. This accounts for the loud report of thunder that was unaccompanied by lightning. The report must be loud from its being near; but no lightning could be perceived, by reason of the thick cloud situated immediately between the spectator and the space betwixt the two clouds where the lightning appears.

11. As the lower cloud gradually approached towards the earth, that part of the latter where the man

and horses were, must of course become superinduced by the elastic electrical pressure of the electrical atmosphere of the thunder-cloud; which superinduced elastic electrical pressure must gradually have increased as the cloud came closer to the earth, and approached nearer to the limit of the striking distance.

12. Hence, if any conducting body (not having prominent or conducting points) were to be placed upon the surface of the earth, and there electrically insulated; then such conducting body, by the laws of electricity, must, at its upper extremity (namely the part nearest to the positive cloud) become negative; at its lower extremity it must become positive; and, at a certain intermediate point, it will be neither plus nor minus. This insulated conducting body, thus situated, will be in three opposite states at the same time, that is to say, it will be, at the same time, positively electrified, negatively electrified, and not electrified at all.—For a demonstration of this proposition, his lordship refers to his Principles of Electricity; but it is a generally known and established fact in electricity.

13. If this conducting body on the surface of the earth be not insulated, or be but imperfectly insulated, then the whole of such body, from its being immersed in the electrical atmosphere of the positive cloud, will become negative; because part of the electricity of the conducting body will in this case pass into the earth, and the conducting body will become the more negative as it becomes the more deeply immersed into the dense part of the elastic electrical atmosphere of the approaching thunder-cloud.

14. When the lower cloud comes suddenly to discharge with an explosion its superabundant electricity into the upper one, then the elastic electrical atmosphere of the former will cease to exist; consequently the electrical fluid, which had been gradually expelled into the common stock from the conducting body on the surface of the earth, must, by the sudden removal of the superinduced elastic electrical pressure of the electrical atmosphere of the thunder-cloud, suddenly return from the earth into the said conducting body, producing a violent commotion similar to the pungent shock of a Leyden jar in its sensation and effects.

15. This, which his lordship calls the *electrical re-* ¹⁹
turning stroke, he supposes to have been what killed the man and horses in the present case, they having become strongly negative before the explosion. The man, according to Mr Brydones account, was sitting when he received the stroke, and his legs were hanging over the fore part of the cart at the time of the explosion. The returning stroke, therefore, could not enter his body through the legs; and this accounts for the skin of his legs not having been at all burnt or shrivelled, as the skin was on many other parts of his body; and it likewise shows the reason why the zig-zag line, which was terminated by the chin, did not extend lower than the thigh.

16. Mr Brydone likewise informs us, that the hair of the horses was much singed over the greater part of their bodies, but was most perceptible on the belly and legs. This is easily accounted for by the returning stroke; for the lower part of the bodies of these animals must of course have been more affected than any other part, as the electrical fire must have rushed suddenly into their bodies through their legs, which had made a deep impression on the dust.

Lightning

¹⁹
Supposed
effects of
the return-
ing stroke.

Lightning.

17. The various effects produced on the cart may be explained also from the returning stroke with equal facility. The splinters were thrown off by reason of the interruption of good conductors; the wood being a much less perfect conductor than the iron. It is also evident, that it was the electrical returning fire that produced the marks of fusion on that part of the iron of the wheels which was in contact with the ground; inasmuch as the whole electricity, at the instant of the explosion, did enter at these places.

18. No person in the leaf verified in the principles of electricity can hesitate to assent to the proposition, that the electrical returning stroke must exist under circumstances similar to those explained above; but it may be objected, as the reviewers formerly did, that the quantity of electricity naturally contained in the body of a man, &c. is by far too small to produce such violent effects. For an answer to this objection, his lordship refers to his book: By way of corroboration, however, he makes the following remarks.

20
Great
strength of
force of a
returning
stroke in
certain
cases.

19. No person can reasonably conclude, that the force of a returning stroke must always be weak when produced by the disturbed electrical fluid of a man's body, by reason that a man's body contains but a small quantity of electricity: for it has never been proved that a man's body contains only a small quantity of electrical fluid; neither is there the smallest reason to believe such an hypothesis, which appears, on many accounts, to be completely erroneous; and if that hypothesis be erroneous, the objection to the strength of an electrical returning stroke remains altogether unsupported by argument. "When a body is said to be *plus* or *positive* (says his lordship), it simply means, that the body contains more than its natural share of electricity, but does not say that it is completely saturated with it. In like manner, when a body is said to be *minus* or *negative*, it only signifies, that the body contains *less* than its natural share of electricity; but does not imply that such body is *completely exhausted* of the electricity which it contains in its natural state. "Now (says he), the strength of natural electricity is so immense, when compared with the very weak effects of our largest and best contrived electrical machines, that I conceive we cannot, by means of artificial electricity, excel, from a man's body, thousandth, or perhaps the ten-thousandth part of the electrical fluid which it contains when in its natural state."

20. An hypothesis which easily accounts for any natural phenomenon has a much better claim to our attention than an opposite one, which prevents it from being intelligibly explained. There is no reason to conclude that any electrical machine, of any given size, is capable of rendering a conducting body either *completely plus* or *completely minus*; but far otherwise. And it would have been as logical for any person some years ago (when electrical machines were not brought to their present state) to have maintained, that those very imperfect machines were capable of rendering a body *completely positive* or *completely negative*, as for us to pretend to do it at this day. We evidently have not, with our machines, even approached the limit of electrical strength, particularly in respect to the returning stroke: for it is remarkable, that, by the laws of electricity, the strength of the electrical returning stroke, near the limit of the striking distance, does increase in a

greater ratio than the strength of the main stroke from the charged body producing the elastic electrical atmosphere superinduced. Thus, let us attempt to produce the returning stroke by means of a metallic conductor of about 20 or 21 inches in length and of about two inches in diameter; and by means of another metallic body of equal dimensions placed parallel to the prime conductor, just out of the limit of the striking distance; and let the prime conductor be charged by one of the common glass globes of less than nine inches in diameter; the returning stroke in this case will be so weak, that it can hardly be said to exist: but if the experiment be made by means of a large cylinder, and by means of a metallic prime conductor of about three feet four inches long, by nearly four inches and an half diameter, and also by means of another metallic body of equal dimensions with this prime conductor, then there will be no kind of comparison betwixt the strength of the returning stroke obtained out of the striking distance, and the strength of the main stroke received immediately from the prime conductor; the sharpness and pungency of the returning stroke being so much superior. The returning stroke in this case is like the sudden discharge of a weakly electrified Leyden jar, provided due attention be paid to the rules for obtaining a strong returning stroke.

21. In the case of a returning stroke, the strength depends, according to his lordship's hypothesis, not so much on the *quantity* of the electric fluid, as on its *velocity*; whence also it depends less on the quantity of surface used than on the strength of the electrical pressure of the elastic electrical atmosphere superinduced upon the body struck previous to the explosion. But the electrical pressure of the elastic electrical atmosphere of the great thunder-cloud which produced the mischief on the present occasion, must have been immensely greater than that of a metallic prime conductor; and it is not surprising that the effects should be proportioned to the causes.

22. His lordship next accounts for the returning stroke not being felt by the man who followed Lau-^{Why the} der's cart. This, he thinks, may in some degree be accounted for by the latter having been higher up the bank; though it may better be done by supposing, that the cloud to have been pending nearer the earth over the spot where Launder was killed, than over the place where his companion was; for, in order to receive a dangerous returning stroke, it is necessary that he should be immersed, not merely in the cloud's atmosphere, but in the dense part of the cloud's electrical atmosphere. It may also be accounted for by supposing that the second cart were either better connected with the common stock, or better insulated; for either of these circumstances will weaken a returning stroke prodigiously. Now Mr Brydone mentions, that there had been an almost total want of rain for many months. He also says, that the ground, at the place where Launder was killed, was remarkably dry, and of a gravelly soil. This state of the ground was particularly adapted to the production of the electrical returning stroke, when produced upon the large scale of nature, where the elastic electrical pressure is so powerful.

To these arguments adduced by his lordship for the existence and strength of the electrical returning stroke, we shall add an account of some experiments published

Lightning,
21
Strength of
the return-
ing stroke
in different
circumstan-
ces.

22
Why the
returning
stroke was
not felt by
the man
who drove
the second
cart.

Lightning, in the Gentleman's Magazine for 1785. They were made with an insulated rod of iron of considerable length, rising some feet higher than a common conductor placed at the other end of the house. A set of bells were affixed to the former, which in a thunder storm, even when the thunder was four or five miles distant, were rung by the electricity of the atmosphere; but whenever a flash of lightning burst from the cloud, even though at the distance just mentioned, the *same flash*, according to our author, passed through the conductor also, and the bells ceased to ring sometimes for several seconds; then they began again, and continued to ring till they were stopped by another flash. This flash which passed thro' the conductor was undoubtedly what earl Stanhope calls the *returning stroke*; of which we must now give some explanation: And in considering the whole doctrine of that stroke, together with the particular explanation laid down by his lordship, the following observations naturally occur.

1. In the experiments made by his lordship to demonstrate the existence of the returning stroke, there is a deception, of which the reviewers take notice, *viz.* that the man touches a large prime conductor, which, by the operation of the machine, becomes negatively electrified as well as himself. Hence when the discharge is made, all the fire returning to that conductor must pass through his body as well as that of which his body itself is supposed to be deprived; and this, though no other cause intervened, must nearly double the strength of the shock. To make the experiment more fairly, it would be necessary to take away this second conductor, and let the man only touch the brass ball communicating with the earth.

2. In this experiment there is another deception, not taken notice of by the reviewers, *viz.* that any body immersed in a positive electrical atmosphere becomes negative. Hence the second conductor, by being applied to the air positively electrified by the machine, becomes almost as strongly negative as if another machine had been applied to it on purpose; and this negative electricity will be the stronger in proportion to the strength of electricity in the air surrounding it. Again, it is well known that a plate of air may be charged by means of two smooth pieces of metal held at a small distance from each other, one of them connected with an electrical machine, and the other with the earth. Now supposing, instead of the usual communication, that a man standing upon an insulating stool, held the lower metallic plate in one hand, and with the other hand touched the earth, or a conductor communicating with it, it is plain, that by touching the upper plate, the electricity acquired by the air between them would be discharged, and that the man would feel what earl Stanhope calls the *returning stroke*; but which in truth is the shock of a charged electric substance, and would therefore be proportionably pungent. Now, in his lordship's experiments, the two conductors answer exactly to the two metallic plates above mentioned; the air between them, receives a charge, and is discharged by the explosion from the prime conductor, because this conductor forms one of the charging plates. It is true, that the round shape of the conductors renders them unfavourable for trying the experiment; and this is one reason why it re-

quires a great power of electricity to make the return-lightning stroke sensible. The thickness of the plate of air interpolated betwixt the two conductors is another reason; but this makes no difference as to the principles; for his lordship's experiment is undoubtedly no other than that of the Leyden phial. Were his lordship to use two flat plates instead of round conductors, the deception would then be removed; and we may venture to determine *à priori*, that the returning stroke would then be not only very severe, but even *dangerous*, with a very powerful machine and large plates.

3. Though the second conductor were entirely removed, yet there would still be a deception in this experiment, for then the surface of the man's body would act in some measure as one of the metallic plates; so that still the experiment would be on the principles of the Leyden phial, though much weaker than before.

4. In order to make this experiment absolutely without deception, the man should stand upon the ground without touching any thing; and in that case we may should be venture to affirm, that he would feel no returning shock. His being insulated varies the nature of the experiment entirely, as will easily be understood from the following considerations.

Under the article **ELECTRICITY**, we have shown, that *positive* electricity does not consist in an accumulation, nor *negative* electricity in a deficiency, of the fluid; but that all electric phenomena are to be accounted for from the mere *motion* of the fluid, and that this motion is always a circulation. We have shown, that in the working of a common machine, the electric fluid comes from the earth; that it is accumulated around the prime conductor; evaporates in the air; and is then silently absorbed by the earth, and recondensed to the machine. Hence, in the charging of a machine which works positively, the earth, and all bodies on its surface, for some way round, are in a negative state; because they are then absorbing the electrical fluid from the atmosphere. That part of the earth indeed directly under the feet of the machine, and perhaps some little way farther, is *positive*; because it is *giving out* electricity; but the negative portion will be much more extensive. When the conductor is discharged by a spark, then the circulation ceases in a great measure by the collision of the two opposite streams of electric matter. All bodies on the surface of the earth, then, as far as it was negatively electrified, must receive what his lordship calls the *returning stroke*; but the electricity being diffused among such a number, and over such a wide extent, it is no wonder that it should be insensible. If, however, we insulate a large conducting body, and then make another part of it communicate with the earth by means of a good conductor, we instantly put it in a situation fit for transmitting more than its share of the electricity of the atmosphere, and reducing it to the state of the insulated rubber of an electrical machine, through which the whole quantity of electricity must pass to the phial held towards it, in order to be charged negatively. In proportion to this quantity transmitted the shock must be, not because the conductor has lost a large share of its *natural* electricity, but because a large quantity is *artificially* made to pass through it. We may therefore safely venture to assert, that, in thunder storms, unless a body transmits *more* than

23
Experiments with an insulated conductor.

24
Deceptions in Earl Stanhope's experiments.

25
Returning stroke not different from that of a charged phial.

26
How the experiment should be properly made.

27
Another explanation of the phenomena.

Lightning: *than its natural proportion* of electric fluid, no shock will be felt, much less can the person be killed.

28
Difficulties which occur in his Lordship's hypothesis.

5. In his explanation of the accident which happened to Lauder, his lordship is reduced to the greatest difficulty, and makes one of the most unphilosophical shifts in the world; no less than that of arranging the clouds of heaven, not according to fact, but according to his own imagination. He supposes the existence of two clouds, one below the other; and ascribes to them various motions and situations, which we have already taken notice of; but who knows whether such clouds ever existed? His Lordship does not pretend that any body ever saw them; and thus he runs into what is termed by logicians a *vicious circle*; he first assumes data, purposely made to accord with his hypothesis, and then proves the hypothesis from the data.

6. Granting the arrangement of the clouds, and every thing that his lordship desires, the main requisite is still wanting, viz. a flash of lightning at a distance to produce the returning stroke. According to him, the distant flash and returning stroke must be simultaneous; but Mr Brydone mentions no such thing: on the contrary, there had been no flash for some little time before; and the immense velocity of the electric fluid will not allow us to suppose that it would take up the usual time betwixt thunder-claps in traveling five or six miles.

7. His lordship accounts for no lightning being seen at the time of the explosion in a very arbitrary and unnatural manner, by supposing it to have proceeded from a discharge of the one imaginary cloud into the other; and that it was not *seen* on account of the thickness of the lower cloud. A much more natural supposition must be, that it happened below the cart-wheels, but was not seen on account of its being daylight, and the cloud of dust which it raised. The succession of noises, too, indicated a succession of explosions, the flashes of which would be less easily observed than a single large one.

8. It seems altogether impossible, that the *return* of any quantity of natural electricity into a body should shatter that body to pieces. In the present case, the fire entered by a small part of the iron of the wheels, and this part was melted. His lordship does not hesitate to own, that the fusion was a proof that the *whole* fire belonging to the cart, man, and horses, or at least to the cart and man, had entered by this part of the wheels, and consequently more than naturally belonged to that small part of iron. The same evidence, however, will hold good with regard to every other part. We grant that the fire entered the man's body by his right thigh: this might have therefore been burnt by receiving the fire belonging to the whole body; but it ought then to have quietly diffused itself through the other parts of his body, or at least if any damage had been done, it ought to have been done only to the internal parts. Instead of this, a broad zig-zag line upon his body indicated a vast quantity of electric matter running along the surface without entering the body at all. In like manner, his hat being torn in pieces, indicated a violent explosion of electric matter at his head, where there ought to have been little or no explosion, as none could be wanted there except what the *hat* had parted with; and it is ridiculous to sup-

pose that *hats* part with such quantities of electricity as would tear them in pieces by its return. The shivering of the cart, the burning and throwing about of the coals, and all the other circumstances of the case, also point out in the clearest manner, not a quantity of electric matter returning to supply any natural deficiency, but an enormous explosion of that matter from the earth overwhelming and destroying whatever stood in its way. That two explosions were made from the earth is very evident, because there were two holes in it; and the very size of these holes indicates a much greater discharge of electricity than we can *reasonably* suppose to have been lost by the man, horses, and cart.

29
Phenomena of the insulated thunder-rod accounted for.

We shall now consider the experiment quoted from the correspondent in the Gentleman's Magazine. These, as well as the accident under consideration, undoubtedly show, that, during the time of a thunder-storm, both atmosphere and earth are affected for a very considerable way. With regard to the *quantity* of this electrical affection, however, though it must undoubtedly be excessive when taken all together, we can by no means agree that it is so taken partially. From an experiment related in the Magazine above quoted, it appears, that the electricity of a violent thunder-storm extends sometimes over a circle of 100 miles diameter. "Electricity (says the author) seldom appeared without a shower; but I was surprised, on the 5th of June 1784, that the bells rang with thin and very high clouds, and without the least appearance of rain, till the next post brought me an account of a violent thunder-storm, and very destructive hail, at a village 50 miles distant." We cannot by any means suppose, that all this space was electrified like a charged phial; otherwise, great as the explosions of lightning are, they would still be much greater. This is evident even in our electrical machines. A single phial may be charged much higher than a battery, as appears by the electrometer; but the battery, though less charged, will have incomparably more power than a single phial. His lordship appears to have deceived himself in this matter, by mistaking the *extent* of the electrified surface for the *quantity* of charge in every part of it. The surface of the earth in a thunder-storm is exactly similar to that of a charged conductor. According to the extent of electrified surface, the spark will be great or small; and just so it is with lightning, for some kinds of it are much more destructive than others. In all cases, however, the *quantity* of electricity in a particular spot is very inconsiderable. Lightning strikes bodies, not because they are highly electrified, but because they afford a communication betwixt the atmosphere and some place below the surface of the earth. This stroke is the aggregate of the whole electricity contained in a circle of probably many miles in diameter; but the returning stroke, if bodies are in their natural state, can only be in proportion to the *quantity* of electricity in each substance contained within that space. It is in fact the lightning itself diffused through the earth which makes the returning stroke; and it is impossible that every substance within two or three miles of the explosion can receive the whole flash, or another equal to it. It is only in cases where the quantity of electricity diffused through a great space, happens to discharge

Lightning. itself through a human body or other conducting substance of no great bulk, that the effects upon the latter can be any way considerable. This was undoubtedly the case with the thunder-rod mentioned by the correspondent in the Magazine; for it received either from the atmosphere or from the earth, at the time of every flash, the whole quantity of electricity which had been diffused for a considerable way round. Pointed bodies, we know, draw off electricity very powerfully; inasmuch that an highly charged jar may be deprived of almost all its power by merely presenting a needle to it. We can be at no loss therefore to understand why a pointed conductor should draw off the electricity from a large portion of the surface of the earth, or from a considerable portion of atmosphere.

We must now, however, inquire into the reason of these appearances of sparks in places at such distance from the explosion of the lightning. To understand this, we must always keep in our eye that principle so fully explained under the article **ELECTRICITY**, viz. that there never is, nor can be, a real deficiency of the electric fluid in any substance or in any place. It is to be considered as an absolute *plenum*, and of consequence it can have no other motion than a circulatory one. At every discharge of lightning therefore from the clouds into the earth, or from one cloud into another, there must be a return of the same quantity to those clouds which have made the discharge. In the vast extent of electrified surface, some part of these returns must undoubtedly be made at great distances from the place where the explosion of lightning happens. As long as matters remain in their natural state, the electric matter will return by innumerable passages in such small streams, that no perceptible effect upon any single substance can take place. But if a body be so situated, that a large portion of the electric matter must return through it from the earth, then such body will undoubtedly be more affected by every flash than the rest of the substances around it; and if the communication with the earth be interrupted, a flash of fire will be perceived betwixt the conducting substance and the earth at the time that a flash bursts out from the cloud. The strength of such a flash, however, must by no means be supposed equivalent to that of the *main* stroke of lightning, unless we could suppose the whole electrical power of the vast circle already mentioned to be discharged through the conductor.

31
Particular
explanation
of the acci-
dent.

But though this may explain the reason of the sparks or flashes observed in the case of the thunder-rod just mentioned, we cannot from this principle account for the accident which befel the man and horses. There was indeed at that time a very violent emission of electricity from the earth, but no distant flash of lightning happened at the same moment with it, to expel the electricity from the earth. It appears therefore, that the electricity had in this case been accumulating in the earth itself, in a manner similar to that which produces earthquakes; and which is fully explained under that article. The thunder-storm was the natural means employed to supply that part of the earth with electricity, which was in the state of charging; and the moment that the quantity thus supplied was thrown back, all signs of electricity must

cease, as much as when that thrown in upon one side of a Leyden phial is again thrown off. Hence, when the flash burst out of the earth, and killed the man and horses, that portion of earth which absorbed the electricity till then, required it no longer; and of consequence the thunder-storm occasioned by this absorption naturally ceased.

That this disposition to an earthquake did really prevail in the earth at that time, is evident from the tremor which Mr Bell felt on the ground when walking in his garden. The stroke which the woman received on the foot, the death of the lamb, and no doubt many similar circumstances, concurred to show that there was an attempt to restore the equilibrium from the earth, as has been already related. The same disposition to an earthquake, however, was afterwards renewed; and on the 11th of August that same year, a smart shock of an earthquake did actually take place, as Mr Brydone informs us in the same paper.

Besides the different kinds of lightning already treated of, it is by no means uncommon to see flashes unattended by any report. There are always of the sheet kind; they happen very frequently in windy weather when the sky is clear; and likewise when the sky is cloudy, immediately before a fall of rain or snow. The general reason of these appears to be, that the electric fluid is the medium by which the vapours are suspended in the atmosphere; and of consequence, every separation of vapour, whether as rain, snow, or hail, must be attended with what is called a *discharge* of electrical matter. The reason why this kind of lightning is never attended with any report is, that there is no particular object against which the force of the flash is directed; but it dissipates itself among the innumerable conducting bodies with which the atmosphere always abounds. It is, however, in a manner impossible to explain the various ways in which this subtle fluid acts. We know not, for instance, in what state it is when acting as a medium of connection betwixt the air and vapour, nor in what its *discharge* into other parts of the atmosphere properly consists. At any rate, we see that a flash of lightning, however limited its extent may appear to us, diffuses its effects over a great space of atmosphere; for after one of these silent flashes, it is no uncommon thing to observe the sky to become obscure though it had been quite serene before; or, if it had been cloudy, to see rain or snow begin to fall in a very few minutes. It is probable indeed, that there is no change whatever that can take place in the atmosphere but by means of electricity; and there is great reason to believe, that the silent discharges of this fluid from one part of the atmosphere to another, many of which are totally invisible, ultimately occasion the whole of the phenomena of **METEOROLOGY**. See that article.

Various parts of his Lordship's Treatise on Elec-Directions³² tricity, besides those already quoted, tend to prove for conducting the utility of *high* and *pointed* conductors, in pre- rods.
ference to those which terminate in a *ball*, or *rounded end*. Towards the end of the performance, the author discusses this matter very particularly; and enumerates the '*necessary requisites*' in erecting them, in number 11; to every one of which we readily sub-

Lightning. subscribe. As this matter is of a popular nature, and on a subject generally interesting, we shall transcribe this list; adding a short explanation to particular articles.—These requisites (says the author) are 11 in number.

‘1st, That the rod be made of such substances as are, in their nature, the *best conductors of electricity*.

‘2dly, That the rod be *uninterrupted, and perfectly continuous*.—This is a very material circumstance. One entire piece of metal cannot perhaps be had: but it is not sufficient that the rods, of which the conductor consists, be *sensibly* in contact; they should be pressed into *actual* contact by means of nuts and screws, with a thin piece of sheet-lead between the shoulders of the joints.

‘3dly, That it be of a *sufficient thickness*.—A copper rod half an inch square, or an iron rod one inch square, or one of lead two inches square, are thought fully sufficient by the author.

‘4thly, That it be perfectly connected with the common stock.—That is, it should be carried deep into the earth, which is frequently dry near the surface; and then continued in a horizontal direction, so as to have the farther extremity dipped, should this be practicable, into water, at the distance of 10 yards or more from the foundation.

‘5thly, That the upper extremity of the rod be as *acutely pointed* as possible.—This termination should be of copper; or rather a very fine and exceedingly acute needle of *gold* should be employed, which will not materially add to the expence.

‘6thly, That it be very finely tapered:—so that the upper extremity may be a cone, the diameter of the base of which may bear an extremely small proportion to its height; for instance, that of *one to forty*.

‘7thly, That it be extremely prominent;—that is, 8, 10, or 15 feet at least above the highest parts of the building. The author lays great stress on this circumstance; in consequence of the law above-mentioned, deduced by him from his experiments, relating to electric atmospheres. According to this law, the density of an electric atmosphere (the *negative* atmosphere, for instance, of the roof of a house, &c. while a *positively* charged cloud hangs over it) diminishes in the inverse ratio of the *square* of the distance from the surface of the body to which that atmosphere belongs. Accordingly, if the rod project 12 feet into this atmosphere, it will reach to a part of it *four* times less dense than if the rod projected only to *half* that distance, or six feet;—and to a part *one hundred and forty* four times rarer, than if it projected only *one foot*.

‘8thly, That each rod be carried, in the shortest convenient direction, from the point at its upper end, to the common stock.

‘9thly, That there be neither large nor prominent bodies of metal upon the top of the building proposed to be secured, but such as are connected with the conductor, by some proper metallic communication.

‘10thly, That there be a *sufficient number* of high and pointed rods.—On edifices of great importance, especially magazines of gun-powder, the author thinks there ought never to be above 40 or 50 feet asunder.

‘11thly, That every part of the rods be very substantially erected.’

The author declares that he has ‘never been able **Lightning.** to hear of a *single* instance, nor does he believe that any one can be produced, of an *high, tapering, and acutely pointed* metallic conductor, having ever, in any country, been struck by lightning; if it had *all* the necessary requisites abovementioned, especially the second and fourth.’

On the whole, it seems to be pretty certain, that both pointed and knobbed metalline conductors have the power of preserving any body placed at a small distance from them from being struck by lightning. This they do, not because they can *attract* the lightning far out of its way, but because the resistance to its passage is always least on that side where they are; and as pointed conductors diminish the resistance more considerably than blunt ones, they seem in all cases to be preferable.—It appears, however, that a single conductor, whether blunt or pointed, is not capable of securing all the parts of a large building from strokes of lightning; and therefore several of them will be required for this purpose; but to what distance their influence extends, hath not been determined, nor does it seem easily capable of being ascertained.

It now remains only to explain some of the more uncommon appearances and effects of lightning. One of these is, that it is frequently observed to kill alternately: that is, supposing a number of people standing in a line; if the first person was killed, the second perhaps would be safe; the third would be killed, and the fourth safe; the fifth killed, &c.—Effects of this kind are generally produced by the most violently kind of lightning; namely, that which appears in the form of balls, and which are frequently seen to divide themselves into several parts before they strike. If one of these parts of a fire-ball strike a man, another will not strike the person who stands immediately close to him; because there is always a repulsion between bodies electrified the same way. Now, as these parts into which the ball breaks have all the same kind of electricity, it is evident that they must for that reason repel one another; and this repulsion is so strong, that a man may be interposed within the stroke of two of them, without being hurt by either.

The other effect of lightning is mentioned under the article JERUSALEM, where those who attempted to rebuild the temple had the marks of crosses imprinted upon their garments and bodies. This may reasonably be thought to arise from the same cause to which the angular appearance of lightning in the air is owing, namely, its violent impetus and velocity, together with the opposition of the atmosphere. A small stroke of lightning, sometimes indeed a very considerable one, cannot always enter the substance of terrestrial bodies, even when it touches them, for reasons already given. In this case it runs along their surface, and, as in its motion it is perpetually resisted by the atmosphere, it undoubtedly has the same angular motion which we often perceive in the atmosphere. If in this situation it happens to touch the human skin, or a garment, especially of linen, as being a conductor, it will undoubtedly leave a mark upon it; and this mark being of a zig-zag form, might, in the above instance, have been either taken for the exact form of a cross.

Lightning
||
Lignum.

cross by the beholders, or have suggested that idea in relating the story to make it appear more wonderful.

These observations may serve to give some idea of the nature of lightning, and its operations after it appears in its proper form and bursts out from the cloud; but for an account of its original formation, and of the powers by which the clouds are at first electrified, and their electricity kept up notwithstanding many successive discharges of lightning, and the quantity of electric matter continually carried off by the rain, &c. see the article THUNDER.

Artificial LIGHTNING. Before the discoveries of Dr Franklin concerning the identity of electricity and lightning, many contrivances were invented in order to represent this terrifying phenomenon in miniature: the combustions of phosphorus in warm weather, the ascension of the vapour of spirit of wine evaporated in a close place, &c. were used in order to support the hypotheses which at that time prevailed; namely, that lightning was formed of some sulphurous, nitrous, or other combustible vapours, floating in long trains in the atmosphere, which by some unaccountable means took fire, and produced all the destructive effects of that phenomenon. These representations, however, are now no more exhibited; and the only true artificial lightning is universally acknowledged to be the discharge of electric matter from bodies in which it is artificially set in motion by our machines.

LIGHTNING was looked upon as sacred both by the Greeks and Romans, and was supposed to be sent to execute vengeance on the earth: Hence persons killed with lightning, being thought hateful to the gods, were buried apart by themselves, lest the ashes of other men should receive pollution from them. Some say they were interred upon the very spot where they died; others will have it that they had no interment, but were suffered to rot where they fell, because it was unlawful for any man to approach the place. For this reason the ground was hedged in, lest any person unawares should contract pollution from it. All places struck with lightning were carefully avoided and fenced round, out of an opinion that Jupiter had either taken offence at them, and fixed upon them the marks of his displeasure, or that he had, by this means, pitched upon them as sacred to himself. The ground thus fenced about was called by the Romans *lidentul*. Lightning was much observed in augury, and was a good or bad omen, according to the circumstances attending it.

LIGNICENCIS TERRA, in the materia medica, the name of a fine yellow bole dug in many parts of Germany, particularly about Emeric in the circle of Westphalia, and used in cordial and astringent compounds.

LIGNUM VITÆ. See GUIACIUM.

LIGNUM Aloë. See EXCOECARIA.

LIGNUM Nephriticum. See GUIALANDINA.

LIGNUM Rhodium, or *Rosewood*, in the materia medica; a wood, or root, chiefly brought to us from the Canary islands. The writers on botany and the materia medica are much divided about the lignum rhodium, not only with regard to the plant which affords it, but likewise in their accounts of the drug itself, and

have described, under this name, *simples* manifestly different. This confusion seems to have arisen from an opinion, that the *rhodium*, and the *aspalathus* (an article of considerable esteem among the ancients, but with regard to which the moderns are very much at a loss), are the same; whence different woods brought into Europe for the unknown *aspalathus*, were fold again by the name of *rhodium*.

In those modern pharmacopœias which admit the lignum rhodium, different Linnæan names are at present given to it: thus the authors of the Dispensatorium Brunsvicensis suppose it to be the *Rhodola rosa* of Linnæus; and those of the Pharmacopœia Rossica, the *Genista Canariensis*. As to *Aspalathus*, the ancients themselves disagree; Dioscorides meaning by this appellation the wood of a certain shrub freed from the bark, and Galen the bark of a root. At present we have nothing under this name in the shops. What was heretofore fold among us as *aspalathus*, were pieces of a pale-coloured wood brought from the East Indies, and more commonly called *calambour*.

The *aspalathus*, *calambour*, and lignum aquila, are supposed to be woods of the nature of *gallochum*, or lignum aloë, but weaker in quality. The lignum rhodium of the shops is usually in long crooked pieces, full of knots, which when cut appear of a yellow colour like box, with a reddish cast: the largest, smoothest, most compact, and deepest coloured pieces, should be chosen; and the small, thin, or pale ones, rejected. The taste of this wood is lightly bitterish, and somewhat pungent; its smell is very fragrant, resembling that of roses: long kept, it seems to lose its smell; but on cutting, or rubbing one piece against the other, it smells as well as at first. Distilled with water, it yields an odoriferous essential oil, in very small quantity. Rhodium is at present in esteem only upon account of its oil, which is employed as an high and agreeable perfume in scenting pomatums and the like. But if we may reason from analogy, this odoriferous sumple might be advantageously applied to more useful purposes; a tincture of it in rectified spirit of wine, which contains in small volume the virtue of a considerable deal of the wood, bids fair to prove a serviceable cordial, not inferior perhaps to any thing of this kind.

LIGNUM Campechense. See HEMATOXILUM.

LIGNUM Cuburinum. See OPHIORHIZA.

LIGULATED, among botanists, an appellation, given to such floccules as have a straight end turned downwards, with three indentures, but not separated into segments.

LIGURIA (anc. geog.), a country of Italy, bounded on the south by the Mediterranean sea, on the north by the Appennine mountains, on the west by part of Transalpine Gaul, and on the east by Etruria. There is a great disagreement among authors concerning the origin of the Ligurians, though most probably they were descended from the Gauls. Some carry up their origin as far as the fabulous heroes of antiquity; while others trace them from the Ligyes, a people mentioned by Herodotus as attending Xerxes in his expeditions against Greece. These Ligyes are by some ancient geographers placed in Colchis; by others, in Albania. According to Diodorus Siculus, the Ligurians led a very wretched life; their country

Lignum
||
Liguria.

Ligusticum,
Ligustrum.

being entirely overgrown with woods, which they were obliged to pull up by the roots, in order to cultivate their land, which was also encumbered with great stones, and, being naturally barren, made but very poor returns for all their labour. They were much addicted to hunting; and, by a life of continual exercise and labour, became so strong, that the weakest Ligurian was generally an overmatch for the strongest and most robust among the Gauls. The women are said to have been almost as strong as the men, and to have borne an equal share in all laborious enterprises. With all their bravery, however, they were not able to resist the Roman power; but were subdued by that warlike nation, about 211 B. C.

LIGUSTICUM, LOVAGE, in botany: A genus of the digynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 45th order, *Umbellatae*. The fruit is oblong, and quinquelobed on each side; the florets are equal; the petals involuted or rolled inwards, and entire. There are seven species; of which the most remarkable are, the levisium or common, and the foticum or Scots lovage. The first is a native of the Apennine mountains in Italy. It has a thick fleshy, deeply-penetrating perennial root, crowned by very large, many-parted, radical leaves, with broad lobes, having incisions at top, upright, strong, channelled stalks, branching six or seven feet high, and all the branches terminated by yellow flowers in large umbels. The second is a native of Scotland, and grows near the sea in various parts of the country. It has a thickish, fleshy, penetrating, perennial root, crowned by large doubly-trifoliated leaves, with broad, short, indented lobes, upright round stalks, half a yard high, terminated by small yellow umbels. Both species are hardy, and easily propagated by seeds sown in spring or autumn.

Medicinal uses, &c. The root of the first species agrees nearly in quality with that of angelica: the principal difference is, that the lovage root has a stronger smell, and a somewhat less pungent taste, accompanied with a more durable sweetness, the seeds being rather warmer than the root; but although certainly capable of being applied to useful purposes, this root is not regarded in the present practice. The leaves of the second are sometimes eaten raw as a salad, or boiled as greens, by the inhabitants of the Hebrides. The root is reckoned a good carminative. They give an infusion of the leaves in whey to their calves to purge them.

LIGUSTRUM, PRIVET, in botany: A genus of the monogynia order, belonging to the diandria class of plants; and in the natural method ranking under the 44th order, *Separiæ*. The corolla is quadrifid; the berry tetraspermous. There is but one species; of which there are two varieties, the deciduous and the evergreen. They are hardy plants, rising from 10 to 15 feet high, adorned with oblong entire leaves, and spikes of infundibuliform oblong white flowers, succeeded by black-berries. They are easily propagated by seed, layers, suckers, or cuttings. They are used for making hedges. The purple colour upon cards is prepared from the berries. With the addition of alum, these berries are said to dye wool and silk of a good and durable green; for which purpose they must be

VOL. X. Part I.

gathered as soon as they are ripe. The leaves are bitter and slightly astringent. Oxen, goats, and sheep, eat the plant; horses refuse it.

LILBURNE (John), an enthusiastic demagogue, who was tyrannically punished by the star-chamber court, being put in the pillory, whipped, fined, and imprisoned, for importing and publishing seditious pamphlets, which he had got printed in Holland; they chiefly reflected on the church of England and its bishops: he suffered in 1637, and in prison was doubly loaded with irons. In 1641, he was released by the long parliament; and from this time, he had the address to make himself formidable to all parties, by his bold, aspiring genius. He signalized himself in the parliament army; and was at one time the secret friend and confidant of Cromwell, and at another his avowed enemy and accuser; so that, in 1650, Cromwell found it to be his interest to silence him, by a grant of some forfeited estates. But after this, he grew outrageous against the protector's government; became chief of the levellers; and was twice tried for high treason, but acquitted by the juries. The last was for returning from exile (having been banished by the parliament) without a pass. He died in 1657, aged 88.

LILIACEOUS, in botany, an appellation given to such flowers as resemble those of the lily.

LILIUM, the LILY, in botany: A genus of the monogynia order, belonging to the hexandria class of plants; and in the natural method ranking under the 10th order, *Coronariæ*. The corolla is hexapetalous, and campanulate, with a longitudinal nectariferous line or furrow; the capsules connected by small cancellated hairs. There are many species; all of them bulbous-rooted, herbaceous, flowery perennials, rising with erect annual stalks three or four feet high, garnished with long narrow leaves, and terminated by fine clusters of large, bell-shaped, hexapetalous flowers of exceeding great beauty, of white, red, scarlet, orange, purple, and yellow colours.

Culture. All the species are propagated by sowing the seeds; and if care is taken to preserve these seeds from good flowers, very beautiful varieties are often produced. The manner of sowing them is as follows: Some square boxes should be procured, about six inches deep, with holes bored in the bottoms to let out the wet: these must be filled with fresh, light, sandy earth; and the seeds sown upon them pretty thick in the beginning of August, and covered over about half an inch deep with light sifted earth of the same kind. They should then be placed where they may have the morning sun; and if the weather proves dry, they must be watered at times, and the weeds carefully picked out. In the month of October the boxes are to be removed to a place where they may have as much sun as possible, and be secured from the north and north-east winds. In spring the young plants will appear, and the boxes are then to be removed into their former situation. In August the smallest roots are to be emptied out of these boxes, and sowed over a bed of light earth, and covered with about half an inch depth of earth of the same kind sifted over them. Here they must be watered, and shaded at times, and defended from the severity of winter by a light covering of straw or pease-haulm in the hardest weather. In

Lilburne,
Lilium.

February, the surface of the bed should be cleared, and a little light earth sifted over it. When the leaves are decayed, the earth should be a little stirred over the roots; and in the month of September following some more earth sifted on. In the September of the following year, the roots must be transplanted to the places where they are to remain, and set at the distance of eight inches; the roots being placed four inches below the surface: this should be done in moist weather. They will now require the same care as in the preceding winters; and, the second year after they are transplanted, the strongest roots will begin to flower. The fine ones should then be removed at the proper season into flower beds, and planted at great distances from one another that they may flower strong.

Medical uses. The roots of the white lily are emollient, maturing, and greatly suppurative. They are used externally in cataplasms for these purposes with success. The common form of applying them is boiled and bruised; but some prefer the roasting them till tender, and then beating them to a paste with oil, in which form they are said to be excellent against burns. Gerard recommends them internally against dropries.

The Kamtschatkene, or Kamtschatka lily, called there *faranne*, makes a principal part of the food of the Kamtschatkans. Its roots are gathered by the women in August, dried in the sun, and laid up for use: they are the best bread of the country; and after being baked are reduced to powder, and serve instead of flour in soups and several dishes. They are sometimes washed, and eaten as potatoes; are extremely nourishing, and have a pleasant bitter taste. Our navigators boiled and eat them with their meat. The natives often parboil, and beat it up with several sorts of berries, so as to form of it a very agreeable confection. Providentially it is an universal plant there, and all the grounds bloom with its flower during the season. Another happiness remarked there is, that while fish are scarce the *faranne* is plentiful; and when there is a dearth of this, the rivers pour in their provisions in redoubled profusion. It is not to the labours of the females alone that the Kamtschatkans are indebted for these roots. A species of mouse saves them a great deal of trouble. The *faranne* forms part of the winter provisions of that little animal: they not only gather them in the proper season, and lay them up in their magazines, but at times have the instinct of bringing them out in sunny weather to dry them, lest they should decay. The natives search for their hoards; but with prudent tenderness leave part for the owners, being unwilling to suffer such useful caterers to perish.

LILLO (George), an excellent dramatic writer, born at London in 1693. He was a jeweller by profession, and followed his business for many years in that neighbourhood with the fairest reputation. He was at the same time strongly attached to the muses, yet seemed to have laid it down as a maxim, that the devotion paid to them ought always to tend to the promotion of virtue, morality, and religion. In pursuance of this aim, Lillo was happy in the choice of his subjects, and showed great power of affecting the heart, by working up the passions to such a height, as to render the distresses of common and domestic life equally interesting to the audiences as that of kings

and heroes, and the ruin brought on private families by an indulgence of avarice, lust, &c. as the havoc made in states and empires by ambition, cruelty, or tyranny. His "George Barnwell," "Fatal Curiosity," and "Arden of Feverham," are all planned on common and well-known stories; yet they have perhaps more frequently drawn tears from an audience than the more pompous tragedies of Alexander the Great, All for Love, &c. In the prologue to "Emeric," which was not acted till after the author's death, it is said, that when he wrote that play, he "was depressed by want," and afflicted by disease; but in the former particular there appears to be evidently a mistake, as he died possessed of an estate of L. 60 a-year, besides other effects to a considerable value. His death happened in 1739, in the 47th year of his age. His works have been lately collected, and published, with an account of his life, in 2 vols 12mo, by Mr T. Davis.

LILLY (John), a dramatic poet, was born in the wilds of Kent, about the year 1553, and educated in Magdalen-college, Oxford, where he took the degree of bachelor of arts in 1573, and that of master in 1575. From Oxford he removed to Cambridge; but how long he continued there, is uncertain. On his arrival in London, he became acquainted with some of Queen Elizabeth's courtiers, by whom he was cherished, and admired as a poet and a wit; and her majesty, on particular festivals, honoured his dramatic pieces with her presence. His plays are nine in number. His first publication, however, printed in 1580, was a romance called *Euphues*, which was universally read and admired. This romance, which Blount, the editor of six of his plays, first introduced a new language, especially among the ladies, is, according to Berkenhout, in fact a most contemptible piece of affectation and nonsense: nevertheless it seems very certain, that it was in high estimation by the women of fashion of those times, who, we are told by Whalley the editor of Ben Jonson's works, had all the phrases by heart; and those who did not speak *Euphuism* were as little regarded at court as if they could not speak French. "He was (says Oldys) a man of great reading, good memory, ready faculty of application, and uncommon eloquence; but he ran into a vast excess of allusion." When or where he died is not known. Anthony Wood says he was living in 1597, when his last comedy was published. After attending the court of Queen Elizabeth 13 years, notwithstanding his reputation as an author, he was under a necessity of petitioning the queen for some small stipend to support him in his old age. His two letters or petitions to her majesty on this subject are preserved in manuscript.

LILLY (William), a noted English astrologer, born in Leicestershire in 1602; where his father not being able to give him more learning than common writing and arithmetic, he resolved to seek his fortune in London. He arrived in 1620, and lived four years as a servant to a mantua-maker in the parish of St Clements Danes; but then moved a step higher to the service of Mr Wright, master of the Salter's company in the Strand, who not being able to write, Lilly among other offices kept his books. In 1627, when his master died, he paid his addresses to the widow, whom he married with a fortune of 1000*l*. Being now

Lilly
||
Lilyæum.

his own master, he followed the puritanical preachers; and, turning his mind to judicial astrology, became pupil to one Evans, a profligate Welsh parson, in that pretended art. Getting a MS. of the *Ars notitia* of Corn. Agrippa, with alterations, he drank in the doctrine of the magic circle, and the invocation of spirits, with great eagerness. He was the author of the *Merlinus Anglicus junior*; *The Supernatural Sight*; and *The White King's Prophecy*. In him we have an instance of the general superstition and ignorance that prevailed in the time of the civil war between Char. I. and his parliament: for the king consulted this astrologer, to know in what quarter he should conceal himself, if he could escape from Hampton court; and general Fairfax, on the other side, sent for him to his army, to ask him if he could tell by his art, whether God was with them and their cause? Lilly, who made his fortune by favourable predictions to both parties, assured the general that God would be with him and his army. In 1648, he published his *Treatise of the three Suns* seen the preceding winter; and also an astrological judgment upon a conjunction of Saturn and Mars. This year the council of state gave him in money 50*l.* and a pension of 100*l.* *per annum*, which he received for two years, and then resigned on some disgust. In June 1660, he was taken into custody by order of the parliament, by whom he was examined concerning the person who cut off the head of king Charles I. The same year he sued out his pardon under the great seal of England. The plague raging in London, he removed with his family to his estate at Hertham; and in October 1666 was examined before a committee of the house of commons concerning the fire of London, which happened in September that year. After his retirement to Hertham, he applied himself to the study of physic, and, by means of his friend Mr Ashmole, obtained from archbishop Sheldon a licence for the practice of it. A little before his death he adopted for his son, by the name of *Merlin junior*, one Henry Coley, a taylor by trade; and at the same time gave him the impression of his almanac, after it had been printed for 36 years. He died in 1681 of a dead palsy. Mr Ashmole set a monument over his grave in the church of Walton upon Thames. His "Observations on the Life and Death of Charles late King of England," if we overlook the astrological nonsense, may be read with as much satisfaction as more celebrated histories; Lilly being not only very well informed, but strictly impartial. This work, with the *Lives of Lilly and Ashmole*, written by themselves, were published in one vol. 8vo, in 1774, by Mr Burnan.

LILY, in botany. See LILIUM.

LILY of the Valley. See CONVALLARIA.

LILYBÆUM (anc. geog.), a city of Sicily, situated on the most westerly promontory of the island of Sicily, and said to have been founded by the Carthaginians on their expulsion from Motya by Dionysius tyrant of Syracuse. It is remarkable for three sieges it sustained; one against Dionysius the tyrant, another against Pyrrhus king of Epirus, and the third against the Romans. The two first failed in their attempts, but the Romans with great difficulty made themselves master of it. No remains of this once state-

ly city are now to be seen, except some aqueducts and temples; though it was standing in Strabo's time.

LILYE (William,) the grammarian, was born in the year 1466 at Oldham in Hampshire; and in 1486, was admitted a senui-commoner of Magdalen college, in Oxford. Having taken the degree of bachelor of arts, he left the university, and travelled to Jerusalem. Returning from thence, he continued five years in the island of Rhodes, where he studied the Greek language, several learned men having retired thither after the taking of Constantinople. From Rhodes he travelled to Rome; where he improved himself in the Greek and Latin languages, under Sulpitius and P. Sabinus. He then returned to London, where for some time he taught a private grammar-school, being the first person who taught Greek in the metropolis. In 1510, when Dr Colet founded St Paul's school, Lilye was appointed the first master; at which time, it seems, he was married and had many children. In this employment he had laboured 12 years, when, being seized by the plague, which then raged in London, he died in February 1523, and was buried in the north yard of St Paul's. He had the character of an excellent grammarian, and a successful teacher of the learned languages. His principal work is *Brevissima institutio, seu ratio grammaticæ cognoscenda*; Lond. 1513. Reprinted times without number, and commonly called *Lilye's grammar*. The English rudiments were written by Dr Colet, dean of St Paul's; and the preface to the first edition, by cardinal Wolsey. The English syntax was written by Lilye; also the rules for the genders of nouns, beginning with *Propria quæ maribus*; and those for the preterperfect tenses and supines, beginning with *Ac in presenti*. The Latin syntax was chiefly the work of Erasmus. See Ward's preface to his edition of Lilye's Grammar, 1732.

LIMA, a city of South America, in Peru, of which it is capital, with an archbishop's see, and an university. It gives its name to the principal audience of Perú; and is surrounded with brick-walls, fortified with several ramparts and bastions, eight yards high. The streets are handsome, and as straight as a line; but the houses are generally only one story high, on account of the earthquakes. However, they are pretty enough, and well adorned, having long galleries on the front. One part of the roofs are covered with coarse linen cloth, and the others only with reeds, which is not inconvenient, because it never rains here; however, the richest inhabitants cover theirs with fine mats or beautiful cotton-cloths. There are trees planted all round their houses, to keep off the heat of the sun. What the houses want in height they have in length and depth; for some of them are 200 feet long, and proportionably broad, so that they have 10 or 12 large apartments on the ground-floor. The royal square is very handsome, and in the middle there is a fountain of bronze, adorned with the image of Fame which spouts up water. On the east and west sides are the public structures, which are well built. The river which crosses Lima forms canals or streams which run to most of the houses, and serve to water their gardens, as well as for other uses. All the churches and convents are extremely rich; and many images of the saints are of massy gold, adorned with jewels. This city is four

Lilye,
Lima.

Lima.
Limaſſol

rules in length, and two in breadth, and is divided into eight parishes; and yet it contains but 28,000 inhabitants, whereof 9000 are Spaniards. They make use of mules to draw their coaches with, and of these there are about 5000. It is the seat of the viceroy, and contains several courts; as that of the viceroy, of the archbishop, of the inquisition, of the crusado, and of the wills. Earthquakes are here very frequent; some of which have done this city a great deal of damage, particularly that in 1746, whereby it was almost destroyed: were it not for this, it would be a perfect paradise; there being plenty of corn, wine, oil, sugar, fruits, and flax. The inhabitants are so rich, that when the viceroy, who was duke of Palata, and sent from Spain to Peru in 1672, made his public entrance into this city, the inhabitants paved the streets he was to pass through with ingots of silver. The inhabitants of Lima are very debauched, but at the same time extremely superstitious, and they have a strong belief in the power of charms. About a fourth part of the city are monks and nuns, who are not a jot more chaste than the rest; and if any one happens to rival a monk, he is in danger of his life, for they always carry a dagger under their frocks. The nuns are such libertines, that it is hard to find any free from the French disease, of which they sometimes die for want of good physicians. The greatest sinners think they atone for all their faults by hearing a mass, and kissing the robe of St Francis or St Dominic, and then they return to their former practices. It is seated on a large, pleasant, fertile plain, on a small river near the sea. W. Long. 68. 45. S. Lat. 12. 15.

Mariti's
Travels
through
Cyprus.

LIMASSOL, or LIMISSO, a town of Cyprus, in the south of the island. Of the ancient city nothing but ruins now remain; though it was a celebrated place, even under the government of the dukes. King Richard, the conqueror of the last of these vassals of the empire, razed it in 1191, and it was never afterwards rebuilt. This city originally was the same as AMATHUS, or AMATHONTE; so famous, as Pausanias tells us, for its temple erected in honour of Venus and Adonis. Amathus was the residence of the nine first kings of the island; and amongst others of Oneliftus, who was subjected afterwards by the arms of Artabanus, the Persian general. This city, erected into an archbishopric in the time of the Christians, has produced a number of personages celebrated for their knowledge and the sanctity of their lives. In the neighbourhood there are several copper mines, which the Turks have been forced to abandon. The following lines, in the tenth book of Ovid's *Metamorphoses*, prove that they were known in the time of that poet:

Capta viri forma, non jam Cytherea curat
Littora, non alio repetit Paphon aequore cinctam,
Piscosaneque Guidoni, gravidamque Amathus metallis.

The place where the new Limaſſol now stands, formerly had the name of *Nemofa*, from the multitude of woods by which it was surrounded. Richard king of England having destroyed Amathonte, Guy de Lusignan in the 12th century laid the foundations of that new city which the Greeks called *Neopolis*. The family of Lusignan, who continued to embellish and fortify it, built there palaces, and Greek and Latin churches; and made it the seat of a bishop. When the island was taken by the Turks in 1570, the Ot-

Lima.
Limb.

toman army entered this city on the 2d of July, and ravaged it without mercy. It was then destroyed by the flames; and at present it is only a wretched place, in which one can scarcely distinguish any remains of its ancient edifices. It is governed by a commissary and a cadi: the latter judges cases only provisionally, before they are carried to the superior tribunal of Nicotia. The harbour is very commodious; and being sheltered from impetuous winds, it affords a safe and calm asylum to vessels when overtaken by a storm. The carob-tree is here more abundant than any where else; and it is from the port of Limaſſol that the greatest quantity of its fruit is exported. The inhabitants export also salt, procured from a lake near Salines. Cotton, wheat, barley, and mulberry-trees, are both plentiful and well cultivated in this part of the island: the ground also produces all kinds of garden stuff. The best Cyprus wine is made from the vines that grow on the hills of Limaſſol. All the wines of the country are collected in this city to be transported to Larnci, where there are the largest cellars, and which on that account becomes the natural centre of commerce.

LIMAX, the *Slug*, or *Naked Snail*; a genus of insects belonging to the order of vermes mollusca. The body is oblong, fitted for crawling, with a kind of muscular coat on the upper part; and the belly is plain. They have four tentacula, or horns, situated above the mouth, which they extend or retract at pleasure.—This reptile is always destitute of shell; but besides that its skin is more clammy and of a greater consistency than that of the snail, the black naked slug has a furrowed cloak, almost as thick and as hard as leather, under which it withdraws its head as within a shell. The head is distinguished from the breast by a black line. It is in its head and back that the snail-stone is found; which is a small pearly and sandy stone, of the nature of lime stones: according to a popular opinion, it cures the tertian ague, if fastened to the patient's arm. These slugs move on slowly, leaving every where clammy and shining marks of their passage. Their coming together is towards the end of spring. The organs of generation are placed, as in the snail, on the right side of the neck. The male implement unfolds with the same mechanism as the finger of a glove when turned inside out. They are sometimes met with hanging in the air with their heads downwards; and their tails, united by a kind of viscous and thick tie, grappled to the branch of a tree. In this situation they remain for three hours, and that is the time of impregnation. They deposit their eggs in the earth. There are eight species, distinguished entirely by their colour; as the black slug, the white slug, the reddish slug, the ash-coloured slug, &c. The black slug is hermaphrodite, both sexes being in each individual, and in the coitus both impregnate and are impregnated at the same time.—A black slug powdered over with snuff, salt, or sugar, falls into convulsions, casts forth all its foam, and dies. See REPRODUCTION.

LIMB, in general, denotes the border or edge of a thing; thus we say, the limb of a quadrant, of the sun, of a leaf, &c.

LIMB, in anatomy, an appellation given to the extremities of the body, as to the arms and legs.

LIMB, *Limbur*, in the church of Rome, is used in two different senses. 1. The limb of the patriarchs is

said to be the place where the patriarchs waited the redemption of mankind : in this place they suppose our Saviour's soul continued from the time of his death to his resurrection. 2. The limb of infants dying without baptism, is a place supposed to be distinct both from heaven and hell ; since, say they, children dying innocent of any actual sin, do not deserve hell ; and, by reason of their original sin, cannot be admitted into heaven.

LIMBAT, the name of a periodical wind common in the island of Cyprus, and of great service in moderating the heats of the climate, which would otherwise be intolerable.

According to the Abbé Mariti, it begins to blow at eight in the morning the first day ; increases as the sun advances till noon ; then gradually weakens, and at three falls entirely. On the second day it arises at the same hour ; but it does not attain its greatest strength till about one in the afternoon, and ceases at four precisely. On the third day it begins as before ; but it falls an hour later. On the five succeeding days, it follows the same progression as on the third ; but it is remarked, that a little before it ceases, it becomes extremely violent. At the expiration of five days it commences a new period like the former. By narrowly observing the sea on that side from which it is about to blow a little before it arises, one may determine what degree of strength it will have during the day. If the horizon is clear, and entirely free from clouds, the wind will be weak, and even almost insensible ; but if it is dark and cloudy, the wind will be strong and violent. This limbath wind, notwithstanding its utility in moderating the excessive heat, often becomes the cause of fevers, especially to the Europeans, from their being less habituated to the climate, more apt than the natives to suffer themselves to be surprized by the cool air when in a state of perspiration. This wind, the falling of which happens an hour sooner or later, is succeeded by a calm, accompanied by a certain moisture that renders the air somewhat heavy. This moisture disappears in the evening, being dissipated by a wind which arises every day at that period. This wind is considered as a land breeze by the inhabitants of the southern and eastern parts of the island ; but it is called a *sea breeze* by those in the northern and western, who indeed receive it immediately from the sea. In summer it blows till four o'clock in the morning ; and when it ceases, it leaves a profound calm, which continues till the hour when the limbath commences. In autumn and winter it never falls till day-break, when it is succeeded by other winds, which proceed from the irregularity of the season. In spring it does not continue longer than midnight ; and is then succeeded by that happy calm, during which those refreshing dews are formed that moisten the earth at sun-rising. The limbath winds, which arise in the beginning of summer, cease about the middle of September ; and this is the period when the most insupportable heats commence, because their violence is not moderated by the smallest breeze. They are, however, luckily not of long duration ; and about the latter end of October they decrease sensibly, as the atmosphere begins to be loaded with watery clouds.

LIMBORCH (Philip), a learned writer among the remonstrants, born at Amsterdam in 1633. After ha-

ving made great proficiency in his studies, he was, in 1655, admitted to preach in public, which he did first at Haerlem. His sermons had in them no affected cloquence ; but were solid, methodical, and edifying. He was chosen minister of Goudja ; from whence he was called to Amsterdam, where he had the professorship of divinity, in which he acquitted himself with great reputation till his death, which happened in 1712. He had an admirable genius, and a tenacious memory. He had many friends of distinction in foreign parts as well as in his own country. Some of his letters to Mr Locke are printed with those of that celebrated author. He had all the qualifications suitable to the character of a sincere divine, lived an example of every virtue, and preserved the vigour of his body and mind to a considerable age. He wrote many works, which are esteemed ; the principal of which are, 1. *Amica collatio de veritate religionis Christianae cum eruditio Judeo*, in 12mo. 2. A complete body of Divinity, according to the opinions and doctrines of the remonstrants. 3. A history of the Inquisition ; which has been translated into English by Dr Samuel Chandler. Limburch also published the works of the famous Episcopius, who was his great-uncle by the mother's side.

LIMBURGH-DUCHY, a province of the Austrian Netherlands, bounded by the duchy of Juliers on the north and east, by Luxembourg on the south, and by the bishopric of Liege on the west. It is about 30 miles in length, and 25 in breadth ; and consists of good arable and pasture land, with plenty of wood, and some iron mines.

LIMBURGH, the capital city of the duchy of Limburgh, in the Austrian Netherlands, is seated on a steep rock near the river Vesle. This town is small, but pleasantly seated on a hill, with shady woods ; and consists chiefly of one broad street, not very well built. It is strong by situation, and almost inaccessible ; however, it was taken by the French in 1675, and by the confederates under the duke of Marlborough in 1663, for the house of Austria, to whom it remains by the treaties of Rastadt and Baden, after having been dismantled. It is famous for its cheese, which is exceedingly good. E. Long. 6. 8. N. Lat. 50. 40.

LIME. See **QUICKLIME**.

LIME-TREE. See **CITRUS**.

LIME OF LINDEN-TREE. See **TILIA**.

LIME-WATER. See **PHARMACY-INDEX**.

LIMS, or **Lyme**. See **LYME**.

LIMERICK, a county of Ireland, in the province of Munster, is bounded on the east by Tipperary, on the west by Kerry, on the north by the river Shannon, and on the south by Cork. It is a fruitful and populous tract, the soil requiring little or no manure in most places : besides rich pasture for sheep and cows, it produces rich crops of all kinds of corn and rape, with some hemp. It gave title of earl to the family of Dongan. It contains 375,320 Irish plantation acres, about fifty-six church livings, though a much greater number of parishes, ten baronies, three boroughs, and sends eight members to parliament. It has some clays, furze, fern, and mountain lands, and is famous for good cyder ; it has been much benefited by the palatines, who settled there and increased tillage ; they are a laborious independent people, most-ly.

Limerick.

ly employed in their own farms. This country is well watered by large and small rivers; the Shannon runs at the north side of the county, and fertilizes its banks. The firing of the inhabitants is chiefly turf, and the bogs are conveniently situated. At Loughill in the west of the county, there is a mine of coal or culm, but it is more used in kilns than in houses. There are few lakes except Lough Gur; and the principal hills are Knockgreny, Knockany, Knockfiring, and Toryhill. The mountains lie weltward, the highest being Knockpatrick or St Patrick's hill. This county is about 45 miles long and 42 broad.

LIMERICK, or *Lough-Meath*, a market-town, a borough, and a bishop's see, now the metropolis of the province of Munster. It is situated on the river Shannon, 94 miles from Dublin; and was the strongest fortrefs in the kingdom. Its ancient name was Lunnach; and during the first ages it was much frequented by foreign merchants, and after the arrival of the Danes was a place of considerable commerce until the 12th century. It was plundered by Mahon, brother of Brien Boromh, after the battle of Sulchoid, in 970; and Brien, in a future period, exacted from the Danes of this city 365 tons of wine as a tribute, which shows the extensive traffic carried on by those people in that article. About the middle of the 6th century, St Munchin erected a church and founded a bishopric here; which, however, was destroyed by the Danes on their taking possession of this port in 873, and remained in ruins until their conversion to the Christian faith in the 10th century; at which period the church of St Munchin was rebuilt, and the bishopric established. Donald O'Brien, about the time of the arrival of the English, founded and endowed the cathedral; and Donat O'Brien, bishop of Limerick, in the 13th century, contributed much to the opulence of the see. About the close of the 12th century, the bishoprick of Innis-Cathay was united to that of Limerick. It was besieged by king William III. in the year 1690; and though there was no army to assist it, the king was obliged to raise the siege. In the year 1691, it was again besieged by the English and Dutch on the 21st of September; and it was obliged to surrender on the 13th of October following, not without the loss of abundance of men; however, the garrison had very honourable and advantageous conditions, being permitted to retire where they thought fit, and the Roman-catholics by these articles were to be tolerated in the free exercise of their religion. Within a century this place was reckoned the second city in Ireland; at present it has lost its rank; not because it thrives less, but because Cork thrives more. It is composed of the Irish and English town; the latter stands on the King's island, formed by the river Shannon. The town is three miles in circumference, having weekly markets on Wednesday and Saturday, and fairs on Easter Tuesday, 1st July, 4th August, and 12th December. There is a privilege annexed to the fair held on 4th August, that, during 15 days, no person can be arrested in the city or liberties, on any process issuing out of the Thollfel court of Limerick. Ardferit and Achadoe, in the county of Kerry, are united to the bishoprick of Limerick. This city returns two members to parliament; and gives title of viscount to the family of Hamilton. It is governed by a mayor, sheriffs, recorder,

aldermen, and burgeses; there is also a barrack and a military governor and town-major: it had some time the privilege of coinage; and different parliaments have been held there. The town was formerly entirely walled in; and in 1760, there were 17 of the city gates standing; but to the great improvement of the place they are now all demolished, except the water-gate of king John's castle. The linen, woollen, and paper manufactures, are carried on here to great extent, and the export of provisions is very considerable. Here are many charitable hospitals and handsome public buildings, besides the cathedral and other churches. A charter was granted to this city by king John, and confirmed in succeeding reigns. Dr Campbell observes, that as you approach Limerick, the grounds grow rich and exquisitely beautiful; the only disagreeable matter is, that the situation renders the air moist, and consequently rather unwholesome to strangers. About six miles from this is the famous Cattle-connel-spa. Limerick is 50 miles from Cork, 50 from Galway, and 73 from Waterford. It appears that Limerick obtained the privilege of having mayors 10 years before that right was allowed to the citizens of London. It was before governed by provosts, of which the first was John Spafford, in 1195 and 1197; during the provostship of Henry Troy a charter was granted, 9 Richard I. whereby the citizens were allowed to choose mayors and bailiffs, Adam Servant, in 1198, being the first mayor. It continued to be governed by mayors and bailiffs, until the office of bailiff was changed into that of sheriff, in 1609.

LIMERICK is also the name of a fair-town in the county of Wexford and province of Leinster; the fairs are four in the year.

LIMINGTON, a town of Hampshire in England. See LYMINGTON.

LIMIT, in a restrained sense, is used by mathematicians for a determined quantity to which a variable one continually approaches; in which sense, the circle may be said to be the limit of its circumscribed and inscribed polygons. In algebra, the term *limit* is applied to two quantities, one of which is greater and the other less than another quantity; and in this sense it is used in speaking of the limits of equations, whereby their solution is much facilitated.

LIMME, a town of Kent, in England, near Hithe, and four miles from Romney, was formerly a port, till choaked up by the sands; and though it is thereby become a poor town, yet it has the horn and mace and other tokens left of its ancient grandeur, and used to be the place where the lord warden of the cinqueports was sworn at his entrance upon his office. The Roman road from Canterbury, called *Stane-street*, ended here; and from the brow of its hill may be seen the ruinous Roman walls almost at the bottom of the marshes. Here formerly was a castle, now converted into a farm-house. When or by whom this edifice was erected is not known. It has, however, great marks of antiquity; as has also the adjoining church, in which are several old tombstones with crosses on them.

LIMNING, the art of painting in water-colours, in contradistinction to painting which is done in oil-colours.

Limning is much the more ancient kind of painting,

Limington
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Limning.

Limning
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Linacre.

ing. Till a Flemish painter, one John van Eyck, better known by the name of *John of Bruges*, found out the art of painting in oil, the painters all painted in water and in fresco, both on their walls, on wooden boards, and elsewhere. When they made use of boards, they usually glued a fine linen cloth over them, to prevent their opening; then laid on a ground of white; lastly, they mixed up their colours with water and size, or with water and yolks of eggs, well beaten with the branches of a fig-tree, the juice whereof thus mixed with the eggs; and with this mixture they painted their pieces.

In limning, all colours are proper enough, except the white made of lime, which is only used in fresco. The azure and ultramarine must always be mixed with size or gum; but there are always applied two layers of hot size before the size-colours are laid on: the colours are all ground in water each by itself; and, as they are required in working, are diluted with size-water. When the piece is finished, they go over it with the white of an egg well beaten; and then with varnish, if required.

To limn, or draw a face in colours: Having all the materials in readiness, lay the prepared colour on the card even and thin, free from hairs and spots over the place where the picture is to be. The ground being laid, and the party placed in a due position, begin the work, which is to be done at three sittings. At the first you are only to dead-colour the face, which will require about two hours. At the second sitting, go over the work more curiously, adding its particular graces or deformities. At the third sitting, finish the whole; carefully remarking whatever may conduce to render the piece perfect, as the cast of the eyes, moles, scars, gestures, and the like.

LIMOGES, an ancient and considerable town of France, in the province of Guienne, and capital of Limosin, with a bishop's see. It is a trading place, and its horses are in great esteem. It is seated on the river Vienne, in E. Long. 1. 22. N. Lat. 42. 48.

LIMOSIN, a province of France, bounded on the north by La Marche, on the east by Auvergne, on the south by Quercy, and on the west by Perigord and Angoumois. It is divided into the Upper and Lower; the former of which is very cold, but the latter more temperate. It is covered with forests of chefnut-trees; and contains mines of lead, copper, tin, and iron; but the principal trade consists in cattle and horses.

LIMPET. See PATELLA.

LIMPURG, a barony of Germany, in the circle of Franconia, included almost entirely within Suabia, and seated to the south of Hall in Suabia. It is about 15 miles long, and eight broad. Gaildorf and Shonburg, near which is the castle of Limpurg, are the principal places.

LIMPURG, a town of Germany, in the electorate of Trier or Treves, and in Wetteravia, formerly free and imperial, but now subject to the electorate of Treves. It is seated on the river Loha. E. Long. 8. 23. N. Lat. 50. 18.

LINARIA, in ornithology. See FRINGILLA.

LINACRE (Thomas), physician, was born at Canterbury about the year 1460, and there educated under the learned William Selling: thence he removed to Oxford, and in 1484 was chosen fellow of All-

Souls college. Tilly, *alias* Selling, his former instructor, being at this time appointed ambassador from King Henry VII. to the court of Rome, Mr Linacre accompanied him to Italy, where he attained the highest degree of perfection in the Greek and Latin languages. At Rome, he applied himself particularly to the study of Aristotle and Galen, in the original. On his return to Oxford, he was incorporated doctor of physic, and chosen public professor in that faculty. But he had not been long in England, before he was commanded to court by King Henry VII. to attend the young Prince Arthur as his tutor and physician. He was afterwards appointed physician to the king, and, after his death, to his successor Henry VIII. Dr Linacre founded two medical lectures at Oxford, and one at Cambridge; but that which most effectually immortalized his name among the faculty, is his being the first founder of the college of physicians in London. He beheld with vexation the wretched state of physic in those times; and, by an application to Cardinal Wolsey, obtained a patent in 1518, by which the physicians of London were incorporated. The intention of this corporation was to prevent illiterate and ignorant medicaliers from practising the art of healing. Dr Linacre was the first president, and held the office as long as he lived. Their meetings were in his own house in Knight-rider street, which house he bequeathed to the college. But our doctor, when he was about the age of 50, took it into his head to study divinity; entered into orders; and was collated, in 1509, to the rectory of Merham. In the same year he was installed prebendary of Wells, in 1518 prebendary of York, and in the following year was admitted precentor of that cathedral. This, we are told, he resigned for other preferments. He died of the stone in the bladder in October 1524, aged 64; and was buried in St Paul's. Thirty-three years after his death, Doctor John Caius caused a monument to be erected to his memory, with a Latin inscription, which contains the outlines of his life and character. He was a man of great natural sagacity, a skilful physician, a profound grammarian, and one of the best Greek and Latin scholars of his time. Erasmus in his epistles speaks highly of the doctor's translations from Galen, preferring them even to the original Greek. His works are, 1. *De emendata structura Latini sermonis, libri sex*; London, printed by Pynson, 1524, 8vo, and by Stephens, 1527, 1532. 2. The rudiments of grammar, for the use of the prince's Mary, printed by Pynson. Buchanan translated it into Latin; Paris, 1536. He likewise translated into very elegant Latin, several of Galen's works, which were printed chiefly abroad at different times. *Alfo Procli Diadochi sphaera*, translated from the Greek; Venet: 1499, 1500.

LINCOLN, a city of England, and capital of a county of the same name, is distant 132 miles from London. It stands on the side of a hill; at the bottom of which runs the river Withum in three small channels, over which are several bridges. The old *Lindum* of the Britons, which stood on the top of the hill, as appears from the vestiges of a rampart, and deep ditches still remaining, was taken and demolished by the Saxons; who built a town upon the south side of the hill down to the river side, which was several times.

Linacre,
Lincoln.

Lincoln.

times taken by the Danes, and as often retaken by the Saxons. In Edward the Confessor's time, it appears, from Doomday-book, to have been a very considerable place; and in the time of the Normans, Malmſbury ſays, it was one of the moſt populous cities in England. William I. built a caſtle upon the ſummit of the hill above the town. The dioceſe, though the biſhopric of Ely was taken out of it by Henry II. and thoſe of Peterborough and Oxford by Henry VIII. is ſtill vaſtly large, containing the counties of Leiceſter, Huntingdon, Bedford, and part of Bucks, making 1255 pariſhes. Though the other churches are mean, the cathedral or minſter is a moſt magnificent piece of Gothic architecture. Here is a prodigious large bell, called *Tom of Lincoln*, which is near five ton in weight, and 23 feet in compaſs. The hill on which the church ſtands is ſo high, and the church itſelf ſo lofty, that it may be ſeen 50 miles to the north, and 30 to the ſouth. Beſides other tombs, it contains one of braſs, in which are the entrails of Queen Eleaſor, wife to Edward I. It is ſaid there were anciently 52 churches, which are now reduced to 14. Such is the magnificence and elevation of the cathedral, that the monks thought the ſight of it muſt be very mortifying to the devil; whence it came to be ſaid of one who was diſpleaſed, *that he looked like the devil over Lincoln*. The declivity on which the city is built being ſteep, the communication betwixt the upper and lower town is very troubleſome, and coaches and horſes are obliged to make a compaſs.

King Edward III. made this city a ſtaple for wool, leather, lead, &c. It was once burnt; once beſieged by King Stephen, who was here defeated and taken priſoner; and once taken by Henry III. from his rebellious barons. It abounded heretofore with monaſteries and other religious houſes. There is a great pool here, formed by the river on the weſt ſide of it, called *Swan-Pool*, becauſe of the multitude of ſwans on it. The Romans north gate ſtill remains entire, by the name of *Newport-Gate*. It is one of the nobleſt of this fort in Britain. It is a vaſt ſemicircle of ſtones of very large dimensions laid without mortar, connected only by their uniform ſhape. This magnificent arch is 16 feet in diameter, the ſtones are four feet thick at the bottom. It ſeems to have a joint in the middle, not a key-ſtone; and on both ſides, towards the upper part, are laid horizontal ſtones of great dimensions, ſome 10 or 12 feet long. This arch riſes from an impoſſible large mouldings, which are not perceivable now; there are alſo divers fragments of the old Roman wall. Over againſt the caſtle is an entrenchment caſt up by king Stephen; and here are carved the arms of John of Gaunt, duke of Lancaſter, who lived here like a king, and had a mint. The city has a communication with the Trent, by a canal called the *Foſs-dyke*. In the centre of the ruined old caſtle there is a handſome modern ſtructure for holding the aſſizes. Its walls are almoſt entire, and very ſubſtantial: the Keep or principal tower is ſituated on a high and very ſteep mount, which yet continues in its original ſtate, but the remains of the tower on it are only five or fix yards high. The outer walls of the caſtle are of very conſiderable height, which appear ſtill higher than they really are from their lofty ſituation and the moat below them. The great gateway is ſtill entire. This city

Lincoln.

is a county of itſelf, and has a viſcountial juriſdiction for 20 miles round, which is a privilege that no other city in England can equal. It now conſiſts principally of one ſtreet above two miles long, well paved, beſides ſeveral croſs and parallel ſtreets well peopled. Here are ſome very handſome modern buildings, but more antique ones; upon the whole, it has an air of ancient greatneſs, ariſing in a great meaſure from the number of monaſtic remains, moſt of which are now converted into ſtables, out-houſes, &c. Upon the hill, in the caſtle are the ruins of the biſhop's palace, and other ruins of ancient grandeur and magnificence. The city is ſupplied with water by ſeveral conduits, among which is a modern one, ſomewhat in the pyramidal ſtyle, enriched with ſculpture. It is governed by a mayor, twelve aldermen, two ſheriffs, a recorder, four chamberlains, a ſword-bearer, four coroners, and above forty common-council men. Here are four charity ſchools, where 120 poor children are taught by the widows of clergymen. The neighbouring courſe is noted for its frequent horſe-races. On the down of Lincoln, towards Boſton, that rare fowl the bultard is ſeen ſometimes, as well as on Saluſbury-Plain. Lincoln-Heath extends above 50 miles, viz. from Sleaford and Ancaſter ſouth to the Humber north, though it is but three or four miles over where broadest. Five miles from Boſton on this extenſive heath, the late Lord Le Deſpenſer built a few years ago a tower for the direction of ſtrangers. It is a lofty ſquare building with a ſtair-caſe, which terminates in a flat roof, and round the baſe is a ſquare court-yard. Great part of this extenſive heath is lately incloſed. The markets here are Tueſdays and Fridays; and there are four fairs in the year. We read that David king of Scots met king John here, on the 22d of November, in the third year of his reign, and performed homage to him on a hill without the city, for his Engliſh territories, in preſence of the archbiſhops of Canterbury, York, and Ragufa, 13 biſhops, and a vaſt number of temporal lords and knights. King Henry VII. kept his court here at Eaſter in 1486. The Jews were once its chief inhabitants, till they were forced to remove, after having impiouſly crucified the child of one Grantham, and thrown it into a well, to this day called *Grantham's Well*. Lincoln has given the title of earl to the family of Clinton ever ſince the reign of Queen Elizabeth. W. Long. 27. 1. N. Lat. 53. 16.

LINCOLN-Shire, a maritime county of England, 77 miles in length and 48 in breadth, is bounded on the eaſt by the German ocean, on the weſt by Nottinghamſhire, on the north by Yorkſhire, on the ſouth by Rutlandſhire, Northamptonſhire, and Cambridgeſhire. It contains 4590 houſes, 24,340 inhabitants, 631 pariſhes, and 31 market towns, whereof five ſend members to parliament, which, with two for the county, make twelve in all. The principal rivers are the Humber, the Trent, the Witham, the Nene, the Welland, the Ankhram, and the Don. It is divided into three parts, Linſay, Keſtoven, and Holland; the air of which laſt is unwholeſome and foggy, on account of the ſens and large marſhes. The ſoil of the north and weſt parts is very fertile, and abounds in corn and paſtures. The eaſt and ſouth parts are not ſo proper for corn; but then they ſupply them with fiſh and fowl in great plenty, particularly ducks and geefe. Lincoln

Lincolnshire is the principal town. By the late inland navigation, this county has communication with the rivers Mersey, Dee, Ribble, Ouse, Darwent, Severn, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles through diverse counties.

LINDESFARN, or **LANDISFARN**. See *HOLM-Jland*.

LINDSAY (Sir David), a celebrated Scots poet, was descended of an ancient family, and born in the reign of king James IV. at his father's seat called the *Mount*, near Cupar in Fifeshire. He was educated at the university of St Andrew's; and, after making the tour of Europe, returned to Scotland in the year 1514. Soon after his arrival, he was appointed gentleman of the bed-chamber to the king, and tutor to the young prince, afterwards James V. From the verses prefixed to his dream, we learn that he enjoyed several other honourable employments at court: but, in 1533, he was deprived of all his places, except that of *Lion king at arms*, which he held to the time of his death. His disgrace was most probably owing to his invectives against the clergy, which are frequent in all his writings. After the decease of king James V. Sir David became a favourite of the earl of Arran, regent of Scotland; but the abbot of Paisley did not suffer him to continue long in favour with the earl. He then retired to his paternal estate, and spent the remainder of his days in rural tranquillity. He died in the year 1553. His poetical talents, considering the age in which he wrote, were not contemptible; but he treats the Romish clergy with great severity, and writes with some humour: but, whatever merit might be formerly attributed to him, he takes such licentious liberties with words, stretching, or carving them for measure or rhyme, that the Scots have a proverb, when they hear an unusual expression, that, *There is nae sic a word in a' Davie Lindsay*. Mackenzie tells us, that his comedies were so facetious, that they afforded abundance of mirth. Some fragments of these comedies are still preserved in manuscript. He is said to have also written several tragedies, and to have first introduced dramatic poetry into Scotland. One of his comedies was played in 1515. Mackenzie says, he understood nothing of the rules of the theatre. He was cotemporary with John Heywood, the first English dramatic poet. His poems are printed in one small volume; and fragments of his plays, in manuscript, are in Mr William Carmichael's collection.

LINDSEY, the third and largest division of the county of Lincolnshire in England. On the east and north it is washed by the sea, into which it runs out with a large front; on the west it has Yorkshire and Nottinghamshire, from which it is parted by the rivers Trent and Dun; on the south it has Kesteven, from which it is separated by the river Witham and the Foss-dyke, which is seven miles long, and was cut by Henry I. between the Witham and the Trent, for the convenience of carriage in those parts. It had its name from Lincoln, the capital of the county, which stands in it, and by the Romans called *Lindum*, by the Britons *Lindcoln*, by the Saxons *Lindo-colligne*, probably from its situation on a hill, and the lakes or woods that were anciently thereabouts; but the Normans called it *Nicol*. It gives title of earl and marquis to the duke of Ancaffer.

VOL. X. Part L

LINDUS, (anc. geog.), a town of Rhodes, situated on a hill on the west side of the island. It was built by Tlepolemus the son of Hercules, according to Diodorus Siculus; by one of the Heliades, grandsons of the Sun, named *Lindus*, according to Strabo. It was the native place of Cleobulus, one of the wise men. Here we see the famous temple of Lindian Minerva, which was built by the daughters of Danaus. Cadmus enriched this temple with many splendid offerings. The citizens dedicated and hung up here the seventh of Pindar's Olympic odes, written in letters of gold. The ruins of that superb edifice are still to be seen on the top of an high hill which overlooks the sea. Some remains of the walls, consisting of stones of an enormous size, still show it to have been built in the Egyptian style. The pillars and other ornaments have been carried off. On the most elevated peak of the rock are the ruins of a castle, which may have served as a fortress to the city. Its circumference is very extensive, and is filled with rubbish.

Lindo, the modern city, stands at the foot of the hill. A bay, of considerable wideness and depth, serves as a harbour to the city. Ships find good anchorage there in twenty fathoms water. They are safely sheltered from the south-west winds, which constantly prevail through the severest season of the year. In the beginning of winter, they cast anchor off a small village named Maffary. Before the building of Rhodes, Lindus was the harbour which received the fleets of Egypt and Tyre. It was enriched by commerce. Mr Savary observes, that a judicious government, by taking advantage of its harbour and happy situation, might yet restore it to a flourishing state.

LINE, in geometry, a quantity extended in length only, without any breadth or thickness. It is formed by the flux, or motion of a point. See *FLUXIONS*, and *GEOMETRY*.

LINE, in the art of war, is understood of the disposition of an army ranged in order of battle, with the front extended as far as may be, that it may not be flanked.

LINE of Battle, is also understood of a disposition of the fleet in the day of engagement; on which occasion the vessels are usually drawn up as much as possible in a straight line, as well to gain and keep the advantage of the wind as to run the same board. See *Naval TACTICS*.

HORIZONTAL LINE, in geography and astronomy, a line drawn parallel to the horizon of any part of the earth.

EQUINOCTIAL LINE, in geography, is a great circle on the earth's surface, exactly at the distance of 90° from each of the poles, and of consequence bisecting the earth in that part. From this imaginary line, the degrees of longitude and latitude are counted.—In astronomy, the equinoctial line is that circle which the sun seems to describe round the earth on the days of the equinox in March and September. See *ASTRONOMY* and *GEOGRAPHY*.

MERIDIAN LINE, is an imaginary circle drawn thro' the two poles of the earth and any part of its surface. See *GEOGRAPHY*, n° 29.

SHIP of the LINE, a vessel large enough to be drawn up in the line, and to have a place in a fight.

L

LINE,

Lindus, Line.

LINE, in genealogy, a series or succession of relations in various degrees, all descending from the same common father. See DESCENT.

LINE, also denotes a French measure containing the 12th part of an inch, or the 144th part of a foot. Geometricians conceive the line subdivided into fix points. The French line answers to the English barley-corn.

Fishing LINE. See *FISHING LINE*.

LINEs, in heraldry, the figures used in armories to divide the shield into different parts, and to compose different figures. / These lines, according to their different forms and names, give denomination to the pieces or figures which they form, except the straight or plain lines. See HERALDRY.

LINEA ALBA, in anatomy, the concourse of the tendons of the oblique and transverse muscles of the abdomen; dividing the abdomen in two, in the middle. It is called *linea*, line, as being straight; and *alba*, from its colour, which is white.—The *linea alba* receives a twig of a nerve from the intercostals in each of its digitations or indentings, which are visible to the eye, in lean persons especially.

LINEAMENT, among painters, is used for the outlines of a face.

LINEAR NUMBERS, in mathematics, such as have relation to length only; such is a number which represents one side of a plain figure. If the plain figure be a square, the linear figure is called a *root*.

LINEAR Problem; that which may be solved geometrically by the intersection of two right lines. This is called a *simple problem*, and is capable but of one solution.

LINEN, in commerce, a well-known kind of cloth chiefly made of flax.—Linen was not worn by the Jews, Greeks, or Romans, as any part of their ordinary dress. Under tunicks of a finer texture supplied the place of shirts: Hence the occasion for frequent bathing. Alexander Severus was the first emperor who wore a shirt: but the use of so necessary a garment did not become common till long after him.

The linen manufacture was probably introduced into Britain with the first settlements of the Romans. The flax was certainly first planted by that nation in the British soil. The plant itself indeed appears to have been originally a native of the east. The woollen drapery would naturally be prior in its origin to the linen; and the fibrous plants from which the threads of the latter are produced, seems to have been first noticed and worked by the inhabitants of Egypt. In Egypt, indeed, the linen manufacture appears to have been very early: for even in Joseph's time it had risen to a considerable height. From the Egyptians the knowledge of it proceeded probably to the Greeks, and from them to the Romans. Even at this day the flax is imported among us from the eastern nations; the western kind being merely a degenerate species of it.

In order to succeed in the linen manufacture, one set of people should be confined to the ploughing and preparing the soil, sowing and covering the seed, to the weeding, pulling, rippling, and taking care of the new seed, and watering and dressing the flax till it is lodged at home: others should be concerned in

the drying, breaking, scutching, and heckling the flax, to fit it for the spinners; and others in spinning and reeling it, to fit it for the weaver: others should be concerned in taking due care of the weaving, bleaching, beetling, and finishing the cloth for the market. It is reasonable to believe, that if these several branches of the manufacture were carried on by distinct dealers in Scotland and Ireland, where our home-made linens are manufactured, the several parts would be better executed, and the whole would be afforded cheaper, and with greater profit.

Staining of LINEN. Linen receives a black colour with much more difficulty than woollen or cotton. The black struck on linen with common vitriol and galls, or logwood, is very perishable, and soon washes out.—Instead of the vitriol, a solution of iron in four strong beer is to be made use of. This is well known to all the calico-printers; and by the use of this, which they call their *iron liquor*, and madder-root, are the blacks and purples made which we see on the common printed linens. The method of making this iron-liquor is as follows: A quantity of iron is put into the four strong beer; and, to promote the dissolution of the metal, the whole is occasionally well stirred, the liquor occasionally drawn off, and the rust beat from the iron, after which the liquor is poured on again. A length of time is required to make the impregnation perfect; the solution being reckoned unfit for use till it has stood at least a twelvemonth. This solution stains the linen of a yellow, and different shades of buff-colour; and is the only known substance by which these colours can be fixed on linen. The cloth stained deep with the iron liquor, and afterwards boiled with madder, without any other addition, becomes of the dark colour which we see on printed linens and cottons; which, if not a perfect black, has a very near resemblance to it. Others are stained paler with the same liquor diluted with water, and come out purple.

Linen may also be stained of a durable purple by means of solution of gold in aqua regia. The solution for this purpose should be as fully saturated as possible; it should be diluted with three times its quantity of water; and if the colour is required deep, the piece, when dry, must be repeatedly moistened with it. The colour does not take place till a considerable time, sometimes several days, after the liquor has been applied: to hasten its appearance, the subject should be exposed to the sun and free air, and occasionally removed to a moist place, or moistened with water.—When solution of gold in aqua regia is soaked up in linen cloths, the metal may be recovered by drying and burning them.

The anacardium nut, which comes from the East-Indies, is remarkable for its property of staining linen of a deep black colour, which cannot be washed out either with soap or alkaline ley. The stain is at first of a reddish-brown, but afterwards turns to a deep black on exposure to the air. The cashew-nut, called the *anacardium of the West-Indies*, differs from the oriental anacardium in its colouring quality. The juice of this nut is much paler than the other, and stains linen or cotton only of a brownish colour; which indeed is very durable, but does not at all change towards blackness.—There are, however, trees, natives of our own colonies, which appear to contain juices of the same

Lin. fame nature with those of India. Of this kind are several, and perhaps the greater number, of the species of the toxicodendron or poison-tree †. Mr Catesby, in his history of Carolina, describes one called there the *poison-ash*, from whose trunk flowed a liquid as black as ink, and supposed to be poisonous; which reputed poisonous quality has hitherto prevented the inhabitants from collecting or attempting to make any use of it. In the Philosophical Transactions for the year 1755, the abbé Mazeas gives an account of three sorts of the toxicodendron raised in a botanic garden in France, containing in their leaves a milky juice, which in drying became quite black, and communicated the same colour to the linen on which it was dropped. The linen thus stained was boiled with soap, and came out without the least diminution of colour; nor did a strong ley of wood-ashes make any change in it. Several of these trees have been planted in the open ground in England, and some still remain in the bishop of London's garden at Fulham.

That species called by Mr Miller the *true lac tree*, was found by Dr Lewis to have properties of a similar kind. It contains in its bark, and the pedicles and ribs of the leaves, a juice somewhat milky, which soon changed in the air to a reddish-brown, and in two or three hours to a deep blackish or brownish-black colour; wherever the bark was cut or wounded, the incision became blackish; and on several parts of the leaves the juice had spontaneously exuded, and stained them of the same colour. This juice dropped on linen gave at first little or no colour, looking only like a spot of oil; but, by degrees, the part moistened with it darkened in the same manner as the juice itself. On washing and boiling the linen with soap, the stain not only was not discharged, but seemed to have its blackness rather improved; as if a brown matter, with which the black was manifestly debased, had been in part washed out, and left the black more pure.

As the milky juice of some of our common plants turn dark-coloured or blackish in drying, the Doctor was induced to try the effects of several of them on linen. The milks of wild-poppies, garden-poppies, dandelion, hawk-weed, and fow-thistle, gave brown or brownish-red stains, which were discharged by washing with soap; the milks of the fig-tree, of lettucees, and of different kinds of spurgees, gave no colour at all. The colourless juice which issues from hop-stalks when cut, stains linen of a pale-reddish, or brownish-red, extremely durable; the colour was deepened by repeated applications of the juice, but it never made any approach to blackness. The juice of flocks gave likewise a pale-brownish stain, which by repeated washings with soap, and being wetted with strong solution of alkaline salt, was darkened to a deeper brown: on baking the flocks, their juice turns red; and the red stain which it then imparts to linen is, on washing with soap, changed to a pale-bluish, which also proves durable. These colours could not be deepened by repeated applications of the juice. The flocks were tried in different states of maturity, from the beginning of September to the middle of December, and the event was always nearly the same.

In the fifth volume of Linnæus's *Amenitates Academicæ*, mention is made of a black colour obtained from

two plants which grow spontaneously in Britain; the one is the *adæa spicata*, herb-christopher, or bane-berries; the other the *erica baccifera nigra*, black-berried heath, crow-berries, or crane-berries. The juice of the bane-berries, boiled with alum, is said to yield a black ink; and the heath-berries, boiled also with alum, to dye linen of a purplish black.

LINEN flowered with Gold-leaf. Dr Lewis informs us of a late manufacture established in London for embellishing linen with flowers and ornaments of gold-leaf. The linen, he says, looks whiter than most of the printed linens; the gold is extremely beautiful, and bears washing well. The Doctor informs us, that he had seen a piece which he was credibly informed had been washed three or four times, with only the same precautions which are used for the finer printed linens; and on which the gold continued entire, and of great beauty.—Concerning the process used in this manufacture, he gives us no particulars.

Fossile LINEN, is a kind of amianthus, which consists of flexible, parallel, soft fibres, and which has been celebrated for the uses to which it has been applied, of being woven, and forming an *incumbustible cloth*. Paper alo, and wicks for lamps, have been made of it. See AMIANTHUS and ASBESTOS.

LING, in zoology. See GADUS.

LINGEN, a strong town of Germany, in the circle of Westphalia, and capital of a county of the same name. It belongs to the king of Prussia; and is situated on the river Embs, in E. Long. 7. 30. N. Lat. 52. 32.

LINGELBACH (John), an excellent painter, born at Franckfort on the Maine in 1625. He first learned the art in Holland, but perfected himself at Rome; where he studied till he was 25 years of age, when he settled at Amsterdam. His usual subjects are fairs, mountebanks, sea-pieces, and landscapes, which he composed and executed exceeding well: his landscapes are enriched with antiquities, animals, and elegant figures; his sea-sights are full of expression, exciting pity and terror, and all his objects are well designed. He had an uncommon readiness in painting figures and animals, on which account he was employed by several eminent artists to adorn their landscapes with such objects; and whatever he inserted in the works of other masters, were always well adapted, and produced an agreeable effect. He died in 1687.

LINIMENT, in pharmacy, a composition of a consistence somewhat thinner than an unguent, and thicker than an oil used for anointing different parts of the body in various intentions.—The materials proper for composing liniments are, fats, oil, balsams, and whatever enters the composition of unguents and plasters.

LINLITHGOW, the chief town of West Lothian in Scotland. It is supposed to be the *Lindum* of Ptolemy; and to take its name from its situation on a lake, which the word *Lin* or *Llyn* signifies.—It is distant 16 miles from Edinburgh, and is a royal borough and feat of a presbytery. It contains between three and four thousand souls; and carries on a considerable trade in dressing of white leather, which is sent abroad to be manufactured. It also employs many hands in dressing of flax; also in wool-combing, the wool for which is brought

Ling
||
Linlithgow.

Linlithgow,
Linnaeus.

brought from the borders. Its port was formerly *Blacknefs*; but since the decline of that place, *Burrowslounnefs*, about two miles diftant from Linlithgow. The town confifts of one open ftreet, from whence lanes are detached on both fides; the houfes are built of ftone, tolerably neat and commodious; and the place is adorned with fome ftately public edifices. The palace, built, as Sibbald fuppofed, on the fite of a Roman ftation, forms a fquare with towers at the corners, and ftands on a gentle eminence, with the beautiful loch behind it to the weft. It was one of the nobleft of the royal refidences; and was greatly ornamented by James V. and VI. Within the palace is a handfome fquare; one fide of which is more modern than the others, having been built by James VI. and kept in good repair till 1746, when it was accidentally damaged by the king's forces making fires on the hearths, by which means the joifts were burnt. A ftone ornamented fountain in the middle of the court was deftroyed at the fame time. The other fides of the fquare are more ancient. In one is a room ninety-five feet long, thirty feet fix inches wide, and thirty-three high. At one end is a gallery with three arches, perhaps for mufic. Narrow galleries run quite round the old part, to preferve communications with the rooms; in one of which the unfortunate Mary Stuart firft faw light. On the north fide of the high ftreet, on an eminence eaft of the palace, ftands St Michael's church; a handfome ftructure, where James V. intended to have erected a throne and twelve ftalls for the fovereign and knights of the order of St Andrew. In the market-place is another fountain of two ftories with eight fpouts, and furmounted like the former with an imperial crown. In one of the ftreets is fhown the gallery whence the regent Murray was fhot. Here was a houfe of Carmelites, founded by the townfpeople in 1290, deftroyed by the reformers 1559. The family of Livingfton, who take the title of earl from this place, are hereditary keepers of this palace, as alfo bailiffs of the king's bailiury, and conftables of Blacknefs caftle; but by their concern in the rebellion of 1715 all thefe honours with their eftate were forfeited to the crown. Sir James Livingfton, fon of the firft earl by marriage with a daughter of Callendar, was created earl of Callendar by Charles I. 1641, which title funk into the other.

LINNEÆUS (Sir Charles), a celebrated botanift and natural hiftorian, was born on May 24. 1707, in a village called *Rofholt* in Smaland, where his father, Nicolas Linnaeus, was then vicar, but afterwards preferred to the curacy of Stenbrohult. We are told, that on the farm where Linnaeus was born, there yet ftands a large lime-tree, from which his anceftors took the furnames of *Tilander*, *Lindelius*, and *Linnaeus*; and that this origin of furnames, taken from natural objects, is not uncommon in Sweden.

This eminent man, whose talents enabled him to reform the whole fciences of natural hiftory, accumulated, very early in life, fome of the higheft honours that await the moft fucceffful proficients in medical fciences; fince we find that he was made profeffor of phyfic and botany, in the univerfity of Upfal, at the age of 34; and fix years afterwards, phyfician to his fovereign the late king Adolphus; who in the year 1753 honoured him ftill farther, by creating him knight of the order of the Polar Star. His honours did not terminate here: for in 1757 he was ennobled; and in 1776 the

prefent king of Sweden accepted the refignation of his office, and rewarded his declining years by doubling his penfion, and by a liberal donation of landed property fettled on him and his family.

It feems probable, that Linnaeus's tafte for the ftudy of nature was caught from the example of his father; who, as he has himfelf informed us, cultivated, as his firft amufement, a garden plentifully ftored with plants. Young Linnaeus foon became acquainted with thefe, as well as with the indigenous ones of his neighbourhood. Yet, from the ftrainings of his father's income, our young naturalift was on the point of being deftined to a mechanical employment: fortunately, however, this defign was over-ruled. In 1717 he was fent to fchool at Wexfio; where, as his opportunities were enlarged, his progrefs in all his favourite purfuits was proportionably extended. At this early period he paid attention to other branches of natural hiftory, particularly to the knowledge of infects.

The firft part of his academical education Linnaeus received under profeffor Stobæus, at Lund, in Scania, who favoured his inclinations to the ftudy of natural hiftory. After a refidence of about a year, he removed in 1728 to Upfal. Here he foon contracted a clofe friendship with Artedi, a native of the province of Angermania, who had already been four years a ftudent in that univerfity, and, like himfelf, had a ftrong bent to the ftudy of natural hiftory in general, but particularly to ichthyology. Soon after his refidence at Upfal, our author was alfo happy enough to obtain the favour of feveral gentlemen of eftablifhed character in literature. He was in a particular manner encouraged in the purfuit of his ftudies by the patronage of Dr Olaus Celfius, at that time profeffor of divinity, and the reftorer of natural hiftory in Sweden; who, being ftruck with the diligence of Linnaeus in defcribing the plants of the Upfal garden, and his extenfive knowledge of their names, not only patronized him in a general way, but admitted him to his houfe, his table, and his library. Under fuch encouragement it is not ftrange that our author made a rapid progrefs, both in his ftudies and the efteem of the profeffors: in fact, we have a very ftriking proof of his merit and attainments, inafmuch as we find, that, after only two years refidence, he was thought fufficiently qualified to give lectures occasionally from the botanic chair, in the room of profeffor Rudbeck.

In the year 1731, the royal academy of fciences at Upfal having for fome time meditated the defign of improving the natural hiftory of Sweden, at the inftance particularly of profefors Celfius and Rudbeck, deputed Linnaeus to make the tour of Lapland, with the fole view of exploring the natural hiftory of that arctic region; to which undertaking, his reputation, already high as a naturalift, and the ftrength of his conftitution, equally recommended him. He left Upfal the 13th of May, and took his route to Gevalia or Gevels, the principal town of Geltricia, 45 miles diftant from Upfal. Hence he travelled through Helſingland into Medlapadia, where he made an excursion, and afcended a remarkable mountain, before he reached Hudwickſwald, the chief town of Helſingland. From hence he went through Angermanland to Hernofand, a fea-port on the Bothnic gulf, 70 miles diftant from Hudwickſwald. When he had proceeded thus far, he found it proper to re-
tard

Linnaeus.

From Dr
Pultney's
General
View of the
Life and
Writings of
Linnaeus.

Linneus.

tard his journey, as the spring was not sufficiently advanced; and took this opportunity of visiting those remarkable caverns on the summit of mount Skula, though at the hazard of his life.

When Linnæus arrived at Uma, in West Bothnia, about 96 miles from Hernofand, he quitted the public road, and took his course through the woods westward, in order first to traverse the most southern parts of Lapland. Being now come to the country that was more particularly the object of his inquiries, equally a stranger to the language and to the manners of the people, and without any associate, he committed himself to the hospitality of the inhabitants, and never failed to experience it fully. He speaks in several places, with peculiar satisfaction, of the innocence and simplicity of their lives and their freedom from diseases. In this excursion he reached the mountains towards Norway; and, after encountering great hardships, returned into West Bothnia, quite exhausted with fatigue. Our traveller next visited Pitha and Lula, upon the gulf of Bothnia; from which latter place he took again a western route, by proceeding up the river of that name, and visited the ruins of the temple of Jockmook in Lula Lapland or Lap Mark; thence he traversed what is called the *Lapland Desert*, destitute of all villages, cultivation, roads, or any conveniences; inhabited only by a few straggling people, originally descended from the Finlanders, and who settled in this country in remote ages, being entirely a distinct people from the Laplanders. In this district he ascended a noted mountain called *Wallevari*; in speaking of which he has given us a pleasant relation of his finding a singular and beautiful new plant (*Andromeda tetragona*) when travelling within the arctic circle, with the sun in his view at midnight, in search of a Lapland hut. From hence he crossed the Lapland Alps into Finmark, and traversed the shores of the north sea as far as Sallero.

These journeys from Lula and Pitha on the Bothnian gulf, to the north shore, were made on foot; and our traveller was attended by two Laplanders, one his interpreter, and the other his guide. He tells us, that the vigour and strength of those two men, both old, and sufficiently loaded with his baggage, excited his admiration; since they appeared quite unhurt by their labour, while he himself, although young and robust, was frequently quite exhausted. In this journey he was wont to sleep under the boat with which they forded the rivers, as a defence against rain, and the gnats, which in the Lapland summer are not less teasing than in the torrid zones. In defending one of these rivers, he narrowly escaped perishing by the oversetting of the boat, and lost many of the natural productions which he had collected.

Linnæus thus spent the greater part of the summer in examining this arctic region, and those mountains on which, four years afterwards, the French philosophers secured immortal fame to Sir Isaac Newton. At length, after having suffered incredible fatigues and hardships in climbing precipices, passing rivers in miserable boats, suffering repeated vicissitudes of extreme heat and cold, and not unfrequently hunger and thirst, he returned to Tornaa in September. He did not take the same route from Tornaa as when he came into Lapland, having determined to visit and examine

Linneus.

the country on the eastern side of the Bothnian gulf; his first stage, therefore, was to Ula in East Bothnia; from thence to Old and New Carleby, 84 miles south from Ula. He continued his route through Wafsa, Christianfadt, and Biornburgh, to Abo, a small university in Finland. Winter was now setting in apace; he therefore crossed the gulf by the island of Åland, and arrived at Upfal in November, after having performed, and that mostly on foot, a journey of ten degrees of latitude in extent, exclusively of those deviations which such a design rendered necessary.

In 1733 he visited and examined the several mines in Sweden; and made himself so well acquainted with mineralogy and the docimastic art, that we find he was sufficiently qualified to give lectures on those subjects upon his return to the university. The outlines of his system on mineralogy appeared in the early editions of the *Systema Nature*; but he did not exemplify the whole until the year 1768.

In the year 1734 Linnæus was sent by baron Reuterholm governor of Dalekaria, with several other naturalists in that province, to investigate the natural productions of that part of the Swedish dominions; and it was in this journey that our author first laid the plan of an excellent institution, which was afterwards executed, in a certain degree at least, by himself, with the assistance of many of his pupils, and the result published under the title of *Pan Suecus*, in the second volume of the *Amnities Academicæ*.

After the completion of this expedition, it appears that Linnæus resided for a time at Fahlun, the principal town in Dalekaria; where he tells us, that he taught mineralogy and the docimastic art, and practised physic; and where he was very hospitably treated by Dr More, the physician of the place. It also appears, that he contracted at this time an intimacy with one of that gentleman's daughters, whom he married about five years afterwards upon his settling as a physician at Stockholm.—In this journey he extended his travels quite across the Dalekarian Alps into Norway; but we have no particular account of his discoveries in that kingdom. In 1735 Linnæus travelled over many other parts of Sweden, some parts of Denmark and Germany, and fixed in Holland, where he chiefly resided until his return to Stockholm, about the year 1739. In 1735, the year in which he took the degree of M. D. he published the first sketch of his *Systema Nature*, in a very compendious way, and in the form of tables only, in 12 pages in folio. By this it appears, that he had at a very early period of his life (certainly before he was 24 years old) laid the basis of that great structure which he afterwards raised, not only to the increase of his own fame, but to that of natural science.

In 1736, Linnæus came into England, and visited Dr Dillenius, the late learned professor at Oxford, whom he justly considered as one of the first botanists in Europe. He mentions with particular respect the civilities he received from him, and the privileges he gave him of inspecting his own and the Sherardian collections of plants. It is needless to say, that he visited Dr Martyn, Mr Rand, and Mr Miller, and that he was in a more singular manner indebted to the friendship of Dr Isaac Lawson. He also contracted an intimate friendship with Mr Peter Collinson, which was reciprocally increased by a multitude

Linnaeus, titude of good offices, and continued to the last without any diminution. Dr Boerhaave had furnished him with letters to our great naturalist Sir Hans Sloane; but, it is with regret that we must observe, they did not procure him the reception which the warmth of his recommendation seemed to claim.

One of the most agreeable circumstances that happened to Linnæus during his residence in Holland, arose from the patronage of Mr Clifford, in whose house he lived a considerable part of his time, being now as it were the child of fortune:—*Exivi patriâ triginta sex nummis aureis dives*—are his own words. With Mr Clifford, however, he enjoyed pleasures and privileges scarcely at that time to be met with elsewhere in the world; that of a garden, excellently stored with the finest exotics, and a library furnished with almost every botanic author of note. How happy he found himself in this situation, those only who have felt the same kind of ardour can conceive. Whilst in Holland, our author was recommended by Boerhaave to fill the place, then vacant, of physician to the Dutch settlement at Surinam; but he declined it on account of his having been educated in so opposite a climate.

Besides being favoured with the particular patronage and friendship of Boerhaave and Mr Clifford, as is above mentioned, our author had also the pleasure of being contemporary with, and of reckoning among the number of his friends, many other learned persons who have since proved ornaments to their profession, and whose merit has most deservedly raised them to fame and honour. Among these we may properly mention Dr John Burman, professor of botany at Amsterdam, whose name and family are well known in the republic of letters, and to whom our author dedicated his *Bibliotheca Botanica*, having been greatly assisted in compiling that work by the free access he had to that gentleman's excellent library; John Frederick Gronovius of Leyden, editor of Clayton's *Flora Virginica*, and who very early adopted Linnæus's system; Baron Van Swieten, late physician to the Empress Queen; Isaac Lawfon, before mentioned, afterwards one of the physicians to the British army, who died much regretted at Oosterhout in the year 1747, and from whom Linnæus received singular and very important civilities; Kramer, since well known for an excellent treatise on the docimastic art; Van Royen, botanic professor at Leyden; Lieberkun of Berlin, famous for his skill in microscopical instruments and experiments. To these may be added also the names of Albinus and Gaubius, and of others, were it requisite to show that our author's talents had very early rendered him conspicuous, and gained him the regard of all those who cultivated and patronised any branch of medical science, and to which, doubtless, the singular notice with which Boerhaave honoured him do not a little contribute.

Early in the year 1738, after Linnæus had left Mr Clifford, and, as it should seem, when he resided with Van Royen, he had a long and dangerous fit of sickness; and upon his recovery went to Paris, where he was properly entertained by the Jusseus, at that time the first botanists in France. The opportunity this gave him of inspecting the Herbaria of Surian and Tournefort, and those of the above-named gentle-

men, afforded him great satisfaction. He had intended to have gone from thence into Germany, to visit Ludwig and the celebrated Haller, with whom he was in close correspondence; but he was not able to complete this part of his intended route, and was obliged to return without this gratification.

Our author did not fail to avail himself of every advantage that access to the several museums of this country afforded him, in every branch of natural history; and the number and importance of his publications, during his absence from his native country, sufficiently demonstrate that fund of knowledge which he must have imbibed before, and no less testify his extraordinary application. These were, *Systema Nature*, *Fundamenta Botanica*, *Bibliotheca Botanica*, and *Genera Plantarum*; the last of which is justly considered as the most valuable of all the works of this celebrated author. What immense application had been bestowed upon it, the reader may easily conceive, on being informed, that before the publication of the first edition the author had examined the characters of 8000 flowers. The last book of Linnæus's composition, published during his stay in Holland, was the *Classes Plantarum*, which is a copious illustration of the second part of the *Fundamenta*.

About the latter end of the year 1738, or the beginning of the next, our author settled as a physician at Stockholm; where he seems to have met with considerable opposition, and was oppressed with many difficulties; but all of these at length he overcame, and got into extensive practice; and soon after his settlement, married the lady before spoken of. By the interest of Count Tessin, who was afterwards his great patron, and even procured medals to be struck in honour of him, he obtained the rank of physician to the fleet, and a stipend from the citizens for giving lectures in botany. And what at this time especially was highly favourable to the advancement of his character and fame, by giving him an opportunity of displaying his abilities, was the establishment of the Royal Academy of Sciences at Stockholm; of which Linnæus was constituted the first president, and to which establishment the king granted several privileges, particularly that of free postage to all papers directed to the secretary. By the rules of the academy, the president held his place but three months. At the expiration of that term, Linnæus made his *Oratio de memorialibus in Insectis*, Oct. 3. 1739; in which he endeavours to excite an attention and inquiry into the knowledge of insects, by displaying the many singular phenomena that occur in contemplating the nature of those animals, and by pointing out, in a variety of instances, their usefulness to mankind in particular, and to the economy of nature in general.

During all this time, however, Linnæus appears to have had his eye upon the botanic and medical chair at Upsal, at this time occupied by Rudbeck, who was far advanced in life. We learn indeed that he was so intent on pursuing and perfecting his great designs in the advancement of his favourite study of nature, that he had determined, if he failed in procuring the professorship at Upsal, to accept the offer that had been made to him by Haller of filling the botanic chair at Gottingen. However, in course of time, he obtained his wish. In the year 1741, upon the resignation

Linnaeus.

signation of Roberg, he was constituted joint professor of physic and physician to the king with Rosen, who had been appointed in the preceding year on the death of Rudbeck. These two colleagues agreed to divide the medical departments between them; and their choice was confirmed by the university. Rosen took anatomy, physiology, pathology, and the therapeutic part; Linnaeus, natural history, botany, materia medica, the dietetic part, and the diagnosis morborum.

During the interval of his removal from Stockholm to Upsal in consequence of this appointment, our professor was deputed by the states of the kingdom to make a tour to the islands of Öland and Gothland in the Baltic, attended by six of the pupils, commissioned to make such inquiries as might tend to improve agriculture and arts in the kingdom, to which the Swedish nation had for some time paid a particular attention. The result of this journey was very successful, and proved fully satisfactory to the states, and was afterwards communicated to the public. On his return he entered upon the professorship, and pronounced before the university his oration *de Peregrinationum intra Patriam necessitate*, October 17. 1741; in which he forcibly displays the usefulness of such excursions, by pointing out to the students that vast field of objects which their country held out to their cultivation, whether in geography, physics, mineralogy, botany, zoology, or economics, and by showing the benefit that must accrue to themselves and their country as rewards to their diligence. That animated spirit which runs through the whole of this composition, renders it one of the most pleasing and instructive of all our author's productions.

Linnaeus was now fixed in the situation that was the best adapted to his character, his taste, and abilities; and which seems to have been the object of his ambition and centre of his hopes. Soon after his establishment, he laboured to get the academical garden, which had been founded in 1657, put on a better footing, and very soon effected it; procuring also a house to be built for the residence of the professor. The whole had been in ruin ever since the fire in 1702; and at the time Linnaeus was appointed professor of botany, the garden did not contain above fifty plants that were exotic. His correspondence with the first botanists in Europe soon supplied him with great variety. He received Indian plants from Jussieu of Paris, and from Van Royen of Leyden; European plants from Halker and Ludwig; American plants from the late Mr Collinson, Mr Cateby, and others; and variety of annuals from Dillenius: in short, how much the garden owed to his diligence and care in a few years, may be seen by the catalogue published under the title of *Hortus Upsalienfis, exhibens Plantas exoticas hortu Upsalienfis Academiae a seculo (Linnaeo) illatas ab anno 1742, in annum 1748, additis, differentiis synonymis, habitationibus, testimoniis, roriorumque descriptionibus, ingratiam studiosæ juventutis*; Holm. 1748, 8vo, pp. 306. tab. 3. By this catalogue it appears, that the professor had introduced 1100 species, exclusively of all the Swedish plants and of varieties; which latter, in ordinary gardens, amount not unfrequently to one-third of the whole number. The preface contains a curious history of the climate at Upsal, and the progress of the seasons throughout the whole year.

Linnaeus.

From the time that Linnaeus and Rosen were appointed professors at Upsal, it should seem that the credit of that university, as a school of physic, had been increasing: numbers of students resorted thither from Germany, attracted by the character of these two able men; and in Sweden itself many young men were invited to the study of physic by the excellent manner in which it was taught, who otherwise would have engaged in different pursuits.

Whilst Linnaeus was meditating one of his capital performances, which had long been expected and greatly wished for, he was interrupted by a tedious and painful fit of the gout, which left him in a very weak and dispirited state; and, according to the intelligence that his friends gave of him, nothing was thought to have contributed more to the restoration of his spirits than the seasonable acquisition, at this juncture, of a collection of rare and undescribed plants.

The fame which our author had now acquired by his *Système Naturel*, of which a sixth edition, much enlarged, had been published at Stockholm in 1748 in 8vo, pp. 232. with eight tables explanatory of the classes and orders (and which was also republished by Gronovius at Leyden, had brought, as it were, a conflux of every thing rare and valuable in every branch of nature, from all parts of the globe, into Sweden. The king and queen of Sweden had their separate collections of rarities; the former at Ulricksfahl; the latter, very rich in exotic insects and shells, procured at a great expence, at the palace of Drottningholm; both of which our author was employed in arranging and describing. Besides these, the museum of the royal academy of Upsal had been augmented by a considerable donation from the king, whilst hereditary prince, in 1746; by another from Count Gyllenborg the year before; by a third from M. Grill, an opulent citizen of Stockholm.

From this time we see the professor in a more elevated rank and situation in life. His reputation had already procured him honours from almost all the royal societies in Europe; and his own sovereign, truly sensible of his merit, and greatly esteeming his character and abilities, favoured him with a mark of his distinction and regard, by creating him a knight of the polar star. It was no longer *laudatur et alget*. His emoluments kept pace with his fame and honours: his practice in his profession became lucrative; and we find him soon after possessed of his country-house and gardens at Hammarby, about five miles from Upsal. He had moreover received one of the most flattering testimonies of the extent and magnitude of his fame that perhaps was ever shewn to any literary character, the state of the nation which conferred it, with all its circumstances, duly considered. This was an invitation to Madrid from the king of Spain, there to preside as a naturalist, with the offer of an annual pension for life of 2000 pitoles, letters of nobility, and the perfect free exercise of his own religion: But, after the most free and grateful acknowledgments of the singular honour done him, he returned for answer, 'that if he had any merits, they were due to his own country.'

In the year 1755, the Royal Academy of Sciences at Stockholm honoured our professor with one of the first premiums, agreeably to the will of Count Sparre;

whom

Linnaeus. who had decreed two gold medals, of ten ducats value each, to be annually given by the academy to the authors of such papers, in the preceding year's Stockholm Acts, as should be adjudged most useful in promoting agriculture particularly, and all branches of rural economy. This medal bore on one side the arms of the count, with this motto, *Superstes in scientiis amor Frederici Sparre*. Linnaeus obtained it in consequence of a paper *De Plantis quæ Alpium Suecicarum indigene, magno rei economiæ et medicæ emolumento fieri possunt*; and the ultimate intention was to recommend these plants, as adapted to culture in Lapland. This paper was inserted in the Stockholm Acts for 1754, Vol. XV. Linnaeus also obtained the *premium centum aureorum*, proposed by the Imperial academy of sciences at Peterburg, for the best paper written to establish or disprove, by new arguments, the doctrine of the sexes of plants. It was, if possible, an additional glory to Linnaeus to have merited this premium from the Peterburg academy; inasmuch as a professor of that society, a few years before, had with more than common zeal, although with a futility like that of the other antagonists of our author, endeavoured to overturn the whole Linnaean system of botany, by attempting to show that the doctrine of the sexes of plants had no foundation in nature, and was unsupported by facts and experiments.

It appears that Linnaeus, upon the whole, enjoyed a good constitution; but that he was sometimes severely afflicted with a *hemiparesis*, and was not exempted from the gout. About the close of 1776, he was seized with an apoplexy, which left him paralytic; and at the beginning of the year 1777, he suffered another stroke, which very much impaired his mental powers. But the disease supposed to have been the more immediate cause of his death, was an ulceration of the urinary bladder; of which, after a tedious indisposition, he died, January 11. 1778, in the 71st year of his age.—His principal other works, beside those already mentioned, are, *The Iter Oelandicum et Gothlandicum*, *Iter Scanicum*, *Flora Suecica*, *Fauna Suecica*, *Materia Medica*, *Philosophia Botanica*, *Genera Morborum*, different papers in the *Acta Upsalienfis*, and the *Amenitates Academicæ*. The last of this great man's treatises was the *Maniſſa Altera*, published in 1771; but before his death he had finished the greatest part of the *Maniſſa Tertia*, afterwards completed and published by his son.

To the lovers of science it will not appear strange, nor will it be unpleasant to hear, that uncommon respect was shewn to the memory of this great man. We are told, that "on his death a general mourning took place at Upsal, and that his funeral procession was attended by the whole university, as well professors as students, and the pall supported by sixteen doctors of physic, all of whom had been his pupils." The king of Sweden, after the death of Linnaeus, ordered a medal to be struck, of which one side exhibits Linnaeus's bust and name, and the other Cybele, in a dejected attitude, holding in her left hand a key, and surrounded with animals and growing plants; with this legend, *Deum lætus angit amisti*; and beneath, *Post obitum Upsalæ, die x. Jan. m.dcc.lxxxviii. Regre jubente*.—The same generous monarch not only honoured the Royal Academy of Sciences with his presence when Linnaeus's

Nº 183.

commemoration was held at Stockholm, but, as a still higher tribute, in his speech from the throne to the assembly of the states, he lamented Sweden's loss by his death. Nor was Linnaeus honoured only in his own country. The late worthy professor of botany at Edinburgh, Dr Hope, not only pronounced an eulogium in honour of him before his students at the opening of his lectures in the spring 1778, but also laid the foundation-stone of a monument (which he afterwards erected) to his memory, in the botanic garden there; which, while it perpetuates the name and merits of Linnaeus, will do honour to the founder, and, it may be hoped, prove the means of raising an emulation favourable to that science which this illustrious Swede so highly dignified and improved.

As to the private and personal character of this illustrious philosopher: His stature was diminutive and puny; his head large, and his hinder part very high; his look was ardent, piercing, and apt to daunt the beholder; his ear not sensible to music; his temper quick, but easily appeased.

Nature had, in an eminent manner, been liberal in the endowments of his mind. He seems to have been possessed of a lively imagination, corrected however by a strong judgment, and guided by the laws of system. Add to these, the most retentive memory, an unremitting industry, and the greatest perseverance in all his pursuits; as is evident from that continued vigour with which he prosecuted the design, that he appears to have formed so early in life, of totally reforming and fabricating anew the whole science of natural history; and this fabric he raised, and gave to it a degree of perfection unknown before; and had moreover the uncommon felicity of living to see his own structure rise above all others, notwithstanding every discouragement its author at first laboured under, and the opposition it afterwards met with. Neither has any writer more cautiously avoided that common error of building his own fame on the ruin of another man's. He every where acknowledged the several merits of each author's system; and no man appears to have been more sensible of the partial defects of his own. Those anomalies which had principally been the objects of criticism, he well knew every artificial arrangement must abound with; and having laid it down as a firm maxim, that every system must finally rest on its intrinsic merit, he willingly commits his own to the judgment of posterity. Perhaps there is no circumstance of Linnaeus's life which shows him in a more dignified light than his conduct towards his opponents. Disavowing controversy, and justly considering it as an unimportant and fruitless sacrifice of time, he never replied to any, numerous as they were at one season.

To all who feel the aid this extraordinary man has brought to natural science, his talents must appear in a very illustrious point of view; but more especially to those who, from similarity of taste, are qualified to see more distinctly the vast extent of his original design, the greatness of his labour, and the elaborate execution he has given to the whole. He had a happy command of the Latin tongue, which is alone the language of science; and no man ever applied it more successfully to his purposes, or gave to description such copiousness, united with that precision and conciseness which so eminently characterise his writings.

The

Linnaeus,
Linnet.

The ardour of Linnaeus's inclinations to the study of nature, from his earliest years, and that uncommon application which he bestowed upon it, gave him a most comprehensive view both of its pleasures and usefulness, at the same time that it opened to him a wide field hitherto but little cultivated, especially in his own country. Hence he was early led to regret, that the study of natural history, as a public institution, had not made its way into the universities; in many of which, logical disquisitions and metaphysical theories had too long prevailed, to the exclusion of more useful science. Availing himself therefore of the advantages which he derived from a large share of eloquence, and an animated style, he never failed to display, in a lively and convincing manner, the relation this study hath to the public good; to incite the great to countenance and protect it; to encourage and allure youth into its pursuits, by opening its manifold sources of pleasure to their view, and showing them how greatly this agreeable employment would add, in a variety of instances, both to their comfort and emolument. His extensive view of natural history, as connected with almost all the arts of life, did not allow him to confine these motives and incitements to those only who were designed for the practice of physic. He also laboured to inspire the great and opulent with a taste for this study; and wished particularly that such as were devoted to an ecclesiastical life should share a portion of natural science; not only as a means of sweetening their rural situation, confined, as many are, perpetually to a country residence, but as what would almost inevitably lead, in a variety of instances, to discoveries which only such situations could give rise to, and which the learned in great cities could have no opportunities to make. Not to add, that the mutual communication and enlargement of this kind of knowledge among people of equal rank in a country situation, must prove one of the strongest bonds of union and friendship, and contribute, in a much higher degree than the usual perishing amusements of the age, to the pleasures and advantage of society.

Linnaeus lived to enjoy the fruit of his own labour in an uncommon degree. Natural history raised itself in Sweden, under his culture, to a state of perfection unknown elsewhere; and was from thence disseminated through all Europe. His pupils dispersed themselves all over the globe; and, with their master's fame, extended both science and their own: More than this, he lived to see the sovereigns of Europe establish several public institutions in favour of this study; and even professorships established in divers universities for the same purpose, which do honour to their founders and patrons, and which have excited a curiosity for the science, and a sense of its worth, that cannot fail to further its progress, and in time raise it to that rank which it is intitled to hold among the pursuits of mankind.

LINNET, in ornithology. See FRINGILLA.—It is remarkable of this bird, that when it builds in hedges, and when in furze-bushes on heaths, in both which places the nests are very common, they are made of very different materials. When they build in hedges, they use the slender filaments of the roots of trees, and the down of feathers and thistles; but when they build on heaths, they use moss, principally for the outer part, finishing it within with such things as the place

Vol. X. Part I.

will afford. These birds will have young ones three or four times a-year, especially if they are taken away before they are able to leave the nests.

When linnets are to be taught to whistle tunes, or to imitate the notes of any other bird, they must be taken from the old one when they are not above four days old; for at this time they have no idea of the note of the old ones, and will be readily taught to modulate their voice like any thing that is most familiar to their ears, and within the compass of their throats. More care is required in feeding them when taken thus young, than when they are left in the nest till nearly fledged; but they will be reared very well upon a food half bread and half rape-seed boiled and bruised: this must be given them several times a-day. It must be made fresh every day, and given them sufficiently moist, but not in the extreme. If it be in the least sour, it gripes and kills them; and if too stiff, it is as mischievous by binding them up.—They must be hung up as soon as taken from the nest, under the bird whose note they are intended to learn; or, if they are to be taught to whistle tunes, it must be done by giving them lessons at the time of feeding; for they will profit more, while young, in a few days, than in a long time afterwards, and will take in the whole method of their notes before they are able to crack hard seeds. Some have attempted to learn them to speak in the manner of the parrot or other birds; and they will arrive at some sort of perfection in it, with great pains.

LINSEED, the seed of the plant linum.—Linseed steeped and bruised in water gives it very soon a thick mucilaginous nature, and communicates much of its emollient virtue to it. See LINUM.

LINT. See FLAX, LINEN, and LINUM.

LINT, in surgery, is the scrapings of fine linen, used by surgeons in dressing wounds. It is made into various forms, which acquire different names according to the difference of their figures.—Lint made up in an oval or orbicular form is called a *pledgit*; if in a cylindrical form, or in shape of a date, or olive-stone, it is called a *dosfil*.

These different forms of lint are required for many purposes; as, 1. To stop blood in fresh wounds, by filling them up with dry lint before the application of a bandage: though, if scraped lint be not at hand, a piece of fine linen may be torn into small rags, and applied in the same manner. In very large hæmorrhages the lint or rags should be first dipped in some styptic liquor, as alcohol, or oil of turpentine; or sprinkled with some styptic powder. 2. To agglutinate or heal wounds; to which end lint is very serviceable, if spread with some digestive ointment, balsam, or vulnerary liquor. 3. In drying up wounds and ulcers, and forwarding the formation of a cicatrix. 4. In keeping the lips of wounds at a proper distance, that they may not hastily unite before the bottom is well digested and healed. 5. They are highly necessary to preserve wounds from the injuries of the air.—Surgeons of former ages formed compresses of sponge, wool, feathers, or cotton; linen being scarce: but lint is far preferable to all these, and is at present universally used.

LINTERNUM, or LITERUM, (anc. geog.), a city of Campania, situated at the mouth of the Clanus, which is also called Liturnus, between Cumæ and Vul-

Linseed
Linnet.

Lintock
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Linum.

Vulturum. It received a Roman colony at the same time with Puteoli and Vulturum; was improved and enlarged by Augustus; afterwards forfeited its right of colonyship, and became a prefecture. Hither Scipio Africanus the Elder retired from the mean envy of his ungrateful countrymen; and here he died, and was buried: though this last is uncertain, he having a monument both here and at Rome. No vestige of the place now remains.

LINTSTOCK, in military affairs, a wooden staff about three feet long, having a sharp point in one end and a sort of fork or crotch on the other; the latter of which serves to contain a lighted match, and by the former the lintstock is occasionally stuck in the ground, or in the deck of a ship during an engagement. It is very frequently used in small vessels, where there is commonly one fixed between every two guns, by which the match is always kept dry, and ready for firing.

LINTZ, a very handsome town of Germany, and capital of Upper Austria, with two fortified castles; the one upon a hill, the other below it. Here is a hall in which the states assemble, a bridge over the Danube, a manufacture of gunpowder, and several other articles. It was taken by the French in 1741, but the Austrians retook it in the following year. E. Long. 14. 33. N. Lat. 48. 16.

LINTZ, a town of Germany, in the circle of the Lower Rhine, and electorate of Cologne, subject to that elector. It is seated on the river Rhine, in E. Long. 7. 1. N. Lat. 50. 31.

LINUM, FLAX; a genus of the pentagynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 14th order, *Grinales*. The calyx is pentaphyllous; the petals are five, the capsule is quinquevalved and decemlocular; and the seeds are solitary.

Species. 1. The *utilissimum*, or common annual flax, hath a taper fibrous root; upright, slender, unbranched stalks, two feet and a half high; garnished with narrow, spear-shaped, alternate grey-coloured leaves; and the stalks divided into footstalks at top, terminated by small blue crenated flowers in June and July; succeeded by large round capsules of ten cells, containing each one seed. 2. The perenne, or perennial Siberian flax, hath a fibrous perennial root, sending up several upright, strong, annual stalks, branching four or five feet high; garnished with small narrow, spear-shaped, alternate leaves of a dark green colour; and terminated by umbellate clusters of large blue flowers in June, succeeded by seeds in autumn. 3. The catharticum, or purging flax, with leaves opposite and lanceolate; the stem bifurcated, and the corollæ acute. This is a very small plant, not above four or five inches high; found wild upon chalky hills and in dry pleasure-grounds. There are 18 other species.

Culture. The first species is cultivated in the fields according to the directions given under the article **FLAX**. The second sort is raised from seed in a bed or border of common garden-earth, in shallow drills six inches asunder; and when the plants are two or three inches high, thin them to the same distance; and in autumn plant them out where they are wanted.

Uses. The first species may justly be looked upon as one of the most valuable of the whole vegetable kingdom; as from the bark of its stalks is manufac-

tured the lint or flax for making all sorts of linen-cloth; from the rags of the linen is-made paper; and from the seeds is expressed the lintseed oil so useful in painting and other trades. The seeds themselves are esteemed an excellent emollient and anodyne: they are used externally in cataplasms, to alluage the pain of inflamed tumors; internally, a slight infusion of lintseed, by way of tea, is recommended in coughs as an excellent pectoral, and of great service in pleurisies, nephritic complaints, and suppressions of urine. The virtue of the third species is expressed in its title: an infusion in water or whey of a handful of the fresh leaves, or a dram of them in substance when dried, are said to purge without inconvenience.

LINUS, in classical history, a native of Colchis, cotemporary with Orpheus, and one of the most ancient poets and musicians of Greece. It is impossible, at this distance of time, to discover whether Linus was the disciple of Orpheus, or Orpheus of Linus. The majority, however, seem to decide this question in favour of Linus. According to archbishop Usher, he flourished about 1280 B. C. and he is mentioned by Eusebius among the poets who wrote before the time of Moses. Diodorus Siculus tells us, from Dionysius of Mitylene the historian, who was cotemporary with Cicero, that Linus was the first among the Greeks who invented verses and music, as Cadmus first taught them the use of letters. The same writer likewise attributes to him an account of the exploits of the first Bacchus, and a treatise upon Greek mythology, written in Pelasgian characters, which were also those used by Orpheus, and by Pronapides the preceptor of Homer. Diodorus says that he added the string *lichanos* to the Mercurian lyre; and ascribes to him the invention of rhyme and melody; which Suidas, who regards him as the most ancient of lyric poets, confirms. Mr Marpurge tells us, that Linus invented cat-gut strings for the use of the lyre, which, before his time, was only strung with thongs of leather, or with different threads of flax strung together. He is said by many writers to have had several disciples of great renown; among whom were Hercules, Thamyris, and, according to some, Orpheus—Hercules, says Diodorus, in learning from Linus to play upon the lyre, being extremely dull and obstinate, provoked his master to strike him; which so enraged the young hero, that, instantly seizing the lyre of the musician, he beat out his brains with his own instrument.

LION, in zoology. See **FELIS**.

LIONCELLES, in heraldry, a term used for several lions borne in the same coat of arms.

LIOTARD, called the *Turk*, an eminent painter, was born at Geneva in 1702, and by his father was designed for a merchant; but, by the persuasion of his friends, who observed the genius of the young man, he was permitted to give himself up to the art of painting. He went to Paris in 1725, and in 1738 accompanied the marquis de Puifieux to Rome, who was going ambassador to Naples. At Rome he was taken notice of by the earls of Sandwich and Belborough, then lord Duncannon, who engaged Liotard to go with them on a voyage to Constantinople. There he became acquainted with the late Lord Edgecumbe, and Sir Everard Fawkener, our ambassador, who persuaded him to come to England, where he staid two years. In his journey to the Levant he had adopted the eastern habit.

Linus
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Liotard.

Lip
||
Lipari.

Lipari.

habit, and wore it here with a very long beard. It contributed much to the portraits of himself, and some thought to draw customers; but he was really a painter of uncommon merit. After his return to the continent, he married a young wife, and sacrificed his beard to Hymen. He came again to England in 1772, and brought a collection of pictures of different masters, which he sold by auction, and some pieces of glass painted by himself, with surprising effect of light and shade, but a mere curiosity, as it was necessary to darken the room before they could be seen to advantage; he asked, too, as usual, extravagant prices to them. He staid here about two years, as in his former journey. He has engraved some Turkish portraits, one of the empress queen and the eldest arch-duchess in Turkish habits, and the heads of the emperor and empress. He painted admirably well in miniature; and finely in enamel, though he seldom practised it. But he is best known by his works in crayons. His likenesses were as exact as possible, and too like to please those who sat to him; thus he had great business the first year, and very little the second. Devoid of imagination, and one would think of memory, he could render nothing but what he saw before his eyes. Freckles, marks of the small-pox, every thing found its place; not so much from fidelity, as because he could not conceive the absence of any thing that appeared to him. Truth prevailed in all his works, grace in very few or none. Nor was there any ease in his out-line; but the stiffness of a bust in all his portraits. *Walpole.*

LIP, in anatomy. See there, n^o 102.

Hare-Lip, a disorder in which the upper lip is in a manner slit or divided, so as to resemble the upper lip of a hare, whence the name. See *SURGERY*.

LIPARA (anc. geog.), the principal of the islands called *Eolias*, situated between Sicily and Italy, with a cognominal town, so powerful as to have a fleet, and the other islands in subjection to it. According to Diodorus Siculus, it was famous for excellent harbours and medicinal waters. He informs us also, that it suddenly emerged from the sea about the time of Hannibal's death. The name is Punic, according to Bochart: and given it, because, being a volcano, it shone in the night. It is now called *Lipari*, and gives name to nine others in its neighbourhood; viz. Stromboli, Pare, Rotto, Panaria, Saline, Volcano, Fenicufa, Alicori, and Ustica. These are called, in general, the *Lipari Islands*. Some of these are active volcanoes at present, though Lipari is not. It is about 15 miles in circumference; and abounds in corn, figs, and grapes; bitumen, sulphur, alum, and mineral waters.

LIPARI, an ancient and very strong town, and capital of an island of the same name in the Mediterranean, with a bishop's see. It was ruined by Barbarossa in 1544, who carried away all the inhabitants into slavery, and demolished the place; but it was rebuilt by Charles V. E. Long. 15. 30. N. Lat. 38. 35.

Lipari, properly, is the general name of a cluster of islands. These, according to Mr Houel, are principally ten in number, the rest being only uninhabitable rocks of narrow extent. The largest and the most populous of them, that above-mentioned, communicates its name to

the rest. *Volcano* is a desert but habitable island, lying south from the large island of Lipari. *Salines*, which lies west-north-west from the same island; *Felicudi*, nearly in the same direction, but twenty miles farther distant; and *Alicudi*, ten miles south-west of *Felicudi*; are inhabited. *Pannari* is east of Lipari, the famous *Stromboli* north-east, and both of them are inhabited. The rest are in a desert state; such as *Basiluzzo*, which was formerly inhabited; *Atalio*, which might be inhabited; and *L'Exambianca*, on which some remains of ancient dwellings are still to be found. *L'Escanera* is nothing but a bare rock.

The *Femicoli*, a word signifying ants, are a chain of small black cliffs which run to the north-east of Lipari, till within a little way of Exambianca and Escanera, rising more or less above the water, according as the sea is more or less agitated.

Ancient authors are not agreed with respect to the number of the Lipari islands. Few of those by whom they are mentioned appear to have seen them: and in places such as these, where subterraneous fires burst open the earth and raise the ocean from its bed, terrible changes must sometimes take place. *Volcanella* and *Volcano* were once separated by a straight sea as to form two islands. The lava and ashes have filled up the intervening strait; and they are now united into one island, and have by this change become much more habitable.

The castle of Lipari stands on a rock on the east quarter of the island. The way to it from the city leads up a gentle declivity. There are several roads to it. This castle makes a part of the city; and on the summit of the rock is the citadel, in which the governor and the garrison resides. The cathedral stands in the same situation. Here the ancients, in conformity to their usual practice, had built the temple of a tutelary god. This citadel commands the whole city; and it is accessible only at one place. Were an hostile force to make a descent on the island, the inhabitants might retreat thither, and be secure against all but the attacks of famine.

The ancient inhabitants had also fortified this place. Considerable portions of the ancient walls are still standing in different places, particularly towards the south: their structure is Grecian; and the stones are exceedingly large, and very well cut. The layers are three feet high, which shows them to have been raised in some very remote period. These remains are surrounded with modern buildings. The remains of walls, which are still to be seen here, have belonged not only to temples, but to all the different sorts of buildings which the ancients used to erect. The vaults, which are in a better state of preservation than any of the other parts of these monuments, are now converted to the purposes of a prison.

In the city of Lipari there are convents of monks of two different orders; but there are no convents for women, that is to say, no cloisters in which women are confined; those, however, whose heads and hearts move them to embrace a state of pious celibacy, are at liberty to engage in a monastic life, with the concurrence of their confessors. They put on the sacred habit, and vow perpetual virginity, but continue to live with their father and mother, and mix in society like other women. The vow and the habit even enlarge

Lipari.

their liberty. This custom will, no doubt, M. Houel observes, appear very strange to a Frenchwoman; but this was the way in which the virgins of the primitive church lived. The idea of shutting them up together did not occur till the fifth century. The life of these religious ladies is less gloomy than that which those under the same vows lead in other countries. They wear cloaths of particular colours, according as they belong to this or that order. Their dress gives them a right to frequent the churches at any hours; and the voice of censure, which takes particular pleasure in directing her attacks against pious ladies, goes so far as to assert, that some young women assume the habit with no other views but that they may enjoy greater freedom.

In this island oxen of a remarkably beautiful species are employed in ploughing the ground. The ancient plough is still in use here. The mode of agriculture practised here is very expeditious. One man traces a furrow, and another follows to sow in it grain and pulse. The ploughman, in cutting the next furrow, covers up that in which the seed has been sown: and thus the field is both ploughed and sown at once. Nature seems to be here uncommonly vigorous and fertile. Vegetation is here more luxuriant, and animals gayer and more healthful, than almost any where else.

Near the city of Lipari, the traveller enters deep narrow roads, of a very singular appearance. The whole island is nothing but an assemblage of mountains, all of them consisting of ashes or lava discharged from the depths of the volcano by which it was at first produced. The particles of this puzzolana, or ashes, are not very hard; the action of the rain-water has accordingly cut out trenches among the mountains; and these trenches being perhaps less uneven than the rest of the surface, have of consequence been used as roads by the inhabitants, and have been rendered much deeper by being worn for so many ages by the feet of men and other animals. These roads are more than five or six fathoms deep, and not more than seven or eight feet wide. They are very crooked, and have echoes in several places. You would think that you were walking through narrow streets without doors or windows. Their depth and windings shelter the traveller from the sun while he is passing through them; and he finds them deliciously cool.

The first volcanic eruption in the Lipari islands, mentioned in history, is that of which Callias takes notice of in his history of the wars in Sicily. Callias was contemporary with Agathocles. That eruption continued without interval for several days and nights; and threw out great stones, which fell at more than a mile's distance. The sea boiled all around the island. The works of Callias are lost, and we know not whether he descended to a detail of particulars concerning the ravages produced by this eruption. Under the consulship of Æmilius Lepidus and L. Aurelius Orestes, 126 years before the Christian era, these islands were affected with a dreadful earthquake. The burning of Ætna was the first cause of that. Around Lipari and the adjacent islands, the air was all on fire. Vegetation was withered; animals died; and fusible bodies, such as wax and resin, became liquid. If the inhabitants of Lipari, from whom our author received these facts, and the writers who have handed down an ac-

count of them, have not exaggerated the truth, we must believe that the sea then boiled around the island; the earth became so hot as to burn the cables by which vessels were fixed to the shore, and consumed the planks, the oars, and even the small boats.

Pliny, the naturalist*, speaks of another similar event which happened 30 or 40 years afterwards, in the time of the war of the allied states of Italy against Rome. One of the Eolian islands, says he, was all on fire as well as the sea; and that prodigy continued to appear, till the senate appealed, by a deputation, the wrath of the gods. From the time of that war, which happened 86 years before the birth of our Saviour; till the year 144 of our era, we have no account of any eruption of these volcanoes: and from that period again, till the year 1444, we hear of no explosion from them, that is, for the space of 1300 years. But, at that time, both Sicily and the Eolian isles were agitated by dreadful shocks of earthquake: the volcano of these isles poured forth streams of lava with an awful violence, and emitted a volume of flame and smoke which rose to an amazing height. After that it discharged enormous stones which fell at the distance of more than six miles.

A century later, in the year 1550, the fury of this volcano was again renewed. The ashes and stones discharged from the crater filled up the strait between Volcano and Volcanello.

About two centuries after that, in the year 1739, there was a sixth eruption. The burblings of the volcanic fire were attended with a noise so dreadful, that it was heard as far as Melazzo in Sicily.

Father Leandro Alberti says, that on one of those dreadful occasions, the women of Lipari, after employing in vain all the saints, vowed to drink no more wine if the volcano should spare them. Their giving up this small gratification was doubtless of great service; yet the eruptions still continue, and have even become more frequent since that time. Only 36 years intervened between this eruption and that which happened in the year 1775. The whole island was then shaken; subterraneous thunder was heard; and considerable streams of flame, with smoke, stones, and vitreous lava, issued from the crater. Lipari was covered over with ashes; and part of itself was conveyed by the winds all the way into Sicily. Five years after, however, in the month of April 1780, there issued a new explosion from Volcano; the smoke was thick, the shocks constant, and the subterraneous noise very frequent. So great was the consternation among the inhabitants of Lipari on this occasion, that the commander Deodati Dolomicu, who visited these islands not long after that event, informs us, that the inhabitants in general, but especially the women, devoted themselves as slaves to the service of the blessed virgin; and wore on their arms, as tokens of their servitude, small iron chains, which they still continue to wear.

This act of piety, however, was not so efficacious as the deputation of the senate had been. For after that deputation, more than 200 years passed before the Eolian isles were afflicted by any other eruption, at least by any considerable one: Whereas, in three years after the ladies devoted themselves in so submissive a manner to the service of the virgin, the isles of Li-

Lipari.

* Lib. ii. cap. 106.

pari were agitated anew by that fatal earthquake which ravaged Calabria, and part of Sicily, on the 5th of February 1783.

The dry baths of St Calogero, in the island of Lipari, are fiores, where sulphureous exhalations, known to be of a salutary nature, ascend out of the earth by holes or spiracles. A range of apartments are built around the place where the exhalations arise. The heat is communicated through those apartments in such a way, that when entering at one end, you advance towards the other, the heat still increases upon you till you gain the middle apartment, and again diminishes in the same manner as you proceed from the middle to the other end of the range of chambers. In consequence of this disposition of these apartments, the sick person can make choice of that temperature which best suits the nature of his disease. There are a few miserable huts and a small chapel for the accommodation of the people who repair to these baths. The people of the place are ready to attend them. Physicians likewise follow their patients thither, when the disease is of such a nature as to render their attendance requisite, and the patient rich enough to afford them handsome fees: but there is no physician settled in the place. Besides these dry baths, there are baths of hot water distinguished by the name of *St Calogero's baths*. There are around them buildings sufficient to lodge a considerable number of sick people with their necessary attendants. At present, however, those buildings are but in a bad condition.

The baths consist of two halls; one square, the other round. The former is antique; it has been built by the Romans; it is arched with a cupola, and 12 feet in diameter; it has been repaired: The other is likewise arched with a cupola both within and without. The water comes very hot into the first. It gushes up from among pieces of lava, which compose a part of the mountain at the foot of which these baths are built. Those stones remain in their natural state. All that has been done is the raising of a square building inclosing them. Within that building the sick persons either sit down on the stones, or immerse themselves in the intervening cavities which are filled with water. They continue there for a certain time, and approach nearer to, or remain at a farther distance from, the spring, according as their physician directs. The place serves also as a stove. The hot vapours arising from the water communicate to the surrounding atmosphere a considerable degree of heat. It is indeed not inferior to that of the hot baths of Termini, which owe their heat to a similar cause. In these baths, therefore, a person can have the benefit either of bathing in the hot water, or of exposing himself to the vapour, the heat of which is more moderate. The bath before mentioned, under the appellation of *dry bath*, is also a stove; but the hot vapour with which it is filled issues directly from the volcano. The place of the bath is, however, at such a distance from the volcanic focus, that the heat is not at all intolerable.

The mountain at the foot of which these baths are situated is round, and terminates at the summit in a rock of petrified ashes, which are very hard and of a very fine grain. This petrification consists of pretty regular strata, and appears to have been greatly prior

in its origin to the adjacent rocks; which consist likewise of ashes, but ashes that have been deposited at a much later period. From this rock there proceeds likewise a stream of hot water, by which some mills in the neighbourhood are moved.

It cannot but appear surprising, that nature has placed nearly on the summit of a volcanic mountain springs which supply so considerable a quantity of water. To account for such a phenomenon would be well worthy of some ingenious naturalist. Nor are these hot springs all; proceeding around the same hill, at about a mile's distance, we find a spring of cold water, which originates from the summit of the same rock; that on the north-west produces three hot springs. The cold water is very pleasant to drink, and much used both by men and cattle.

Among these mountains there are many enormous loose masses of lava, the appearance of which, M. Houel informs us, naturally leads the observer to take notice, that the lava of the volcano of Lipari is of a much greater diversity of colours, and those richer and more lively, than the lava of Vesuvius and Etna: The lava of Lipari is in some places, for several miles, of a beautiful red colour. It contains likewise in great abundance small black crystallised scoriae, as well as the small white grains which are commonly found in lava.

Among the eminences which overlook the city of Lipari, there are some rocks of a species which is very rare in Europe. Those are large masses of vitrified matter, which rise six or eight feet above the surface of the ground, and appear to extend to a great depth under it. They exist, through that range of mountains, in enormous masses, mixed with lavas of every different colour, and always standing detached and insulated. Were they cut and followed under ground, they would probably be found to exist in immense quarries in the bowels of the earth. The glass of which they consist might be employed with great advantage in manufactures. It is ready made, and might be easily purified. It is green, compact, and transparent.

The cultivation of the ground is the chief employment of the inhabitants of Lipari. The possession of a few acres of land here gives a man great importance. Parents, when they settle their children, rather give them money than any part of their lands.

More than two-thirds of the island is planted with vines: three-fourths of the grapes which these produce are dried, and sent mostly to London under the name of *Passola*. There are different sorts of passola: one of these, called the *black passolina*, is prepared from a particular kind of grape, of which the berries are uncommonly small; and sold to Marseilles, Holland, and Trieste. The vines are in small arbours, which rise only to the height of two feet and an half above the ground. Under those arbours there grow beans, gourds, and other leguminous vegetables. In so hot a climate, the shade of the vines does not injure but protect the vegetables growing under it: they would otherwise be withered by the heat of the sun.

The method of preparing passola and passolina is curious enough: They first make a lixivium of common ashes; after boiling this, they pass it through a cloth or a sieve; they then put it again on the fire; and

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Lipari
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Lippi.

when it is observed to boil hard, suddenly immerse the grapes, but instantly bring them out again, and expose them to the sun to dry on broad frames of cane. When sufficiently dry, the raisins are put into casks and barrels to be sold and exported. The number of casks of different sorts of raisins annually exported from Lipari are estimated at 10,000.

This island likewise produces figs. There is some white malmsey and a little red wine exported from it.

About 60 or 80 years since, sulphur was one of the articles with which the inhabitants of this island supplied foreign merchants. But that trade has been given up; from an idea which the Liparese entertain, that sulphur infects the air so as to injure the fertility of the vines. The same prejudice prevails in Sicily; but it seems to be ill-founded.

There are courts of justice in Lipari, of the same powers and character with those in the cities of Sicily. Causes of more than ordinary importance are carried to Palermo.

The island is entirely free from every kind of imposition. The king receives nothing from it; because Count Roger anciently bestowed on its bishop all his rights of royalty over Lipari. The bishop there received annually from the inhabitants a tenth part of the products of their lands. They afterwards, to prevent fraud, estimated the value of that tithe for one year; and on the condition of their paying in future a sum of money equal to what that year's tithe was valued at, he not only gave up his right to the tithe, but also ceded to them a considerable extent of land which belonged to him.

In the archiepiscopal palace, and in the palace of the Baron de Monizio, there are some noble pieces of painting by Sicilian painters:—A St Peter, a St Rosalia, his disciples disputing with the Jewish doctors, the adulterous woman, the incredulity of St Thomas.

LIPOTHYMIA, FAINTING, may arise from several causes; as too violent exercise, suppression of the menses or other accustomed evacuations, &c. See (the *Index* subjoined to) MEDICINE.

LIPPA, a town of Hungary, with a castle. It was taken by the Turks in 1552; by the Imperialists in 1688; and by the Turks again in 1691; who abandoned it in 1695, after having demolished the fortifications. It is seated on a mountain, in E. Long. 21. 55. N. Lat. 36. 5.

LIPPE, the capital of a country of the same name in Germany, and the circle of Westphalia. It is seated on a river of the same name, and was formerly the residence of the principal branch of the house of Lippe. It is now in the possession of the king of Prussia, and carries on a good trade in preparing timber for building vessels on the Rhine, with which it has a communication by the river Lippe. The country round it is unwholesome and marshy. E. Long. 8. 12. N. Lat. 51. 43.

LIPPI (Lorenzo), a painter of history and portraits, was born in 1606, and learned the principles of painting from Matteo Roselli. He had an exquisite genius for music and poetry, as well as for painting; and in the latter, his proficiency was so great, that some of his compositions in the historical style were taken for those of Roselli. However, growing at last dissatisfied with the manner of that master, he chose the manner of Santi di Titi, who was excellent both in design and

invention, and appeared to have more of simple nature and truth in his compositions than any other artist of that time. At Florence Lippi painted many grand designs for the chapels and convents, by which he enlarged his reputation; and at the court of Inspruck, he painted a great number of portraits of the first nobility, which were deservedly admired. Yet, altho' he was fond of imitating simple nature without any embellishments from invention, his works are held in the highest esteem for the graceful airs of the heads, for the correctness of his outline, and for the elegant disposition of the figures. He died in 1664.

LIPSIUS (Justus), a learned critic, was born at Ilich, a small village near Brussels, in 1547. After having distinguished himself in polite literature, he became secretary to cardinal de Granvella at Rome, where the best libraries were open to him; and he spent much labour in collating the MSS. of ancient authors. He lived 13 years at Leyden; during which he composed and published what he esteems his best works; but settled at Louvain, where he taught polite literature with great reputation. He was remarkable for unsteadiness in religion, fluctuating often between the Protestants and Papists; but he became finally a bigotted catholic. He died at Louvain in 1606; and his works are collected in six volumes folio.

LIQUEFACTION, an operation by which a solid body is reduced into a liquid; or the action of fire or heat on fat and other fusible bodies, which puts their parts into a mutual intestine motion.—The liquefaction of wax, &c. is performed by a moderate heat; that of sal tartari, by the mere moisture of the air. All salts liquefy; sand, mixed with alkalies, becomes liquefied by a reverberatory fire, in the making of glass. In speaking of metals, instead of liquefaction, we ordinarily use the word *fusion*.

LIQUID, a body which has the property of fluidity; and, besides that, a peculiar quality of wetting other bodies immersed in it, arising from some configuration of its particles, which disposes them to adhere to the surfaces of bodies contiguous to them. See FLUID.

LIQUID, among grammarians, is a name applied to certain consonants opposed to mutes. Thus l, m, n, and r, are liquids.

LIQUIDAMBAR, SWEET-GUM-TREE, in botany: A genus of the polyandria order, belonging to the monœcia class of plants; and in the natural method ranking with those of which the order is doubtful. The male calyx is common, and triphyllous; there is no corolla, but numerous filaments; the female calyces are collected into a spherical form, and tetraphyllous; there is no corolla, but seven styles; and many bivalved and monospermous capsules collected into a sphere. There are only two species, both deciduous, viz. 1. The styraciflua, or the Virginia or maple-leaved liquidambar; a native of the rich moist parts of Virginia and Mexico. It will shoot in a regular manner to thirty or forty feet high, having its young twigs covered with a smooth, light-brown bark, while those of the older are of a darker colour. The leaves are of a lucid green, and grow irregularly on the young branches, on long footstalks: They resemble those of the common maple in figure; the lobes are all serrated; and from the base of the leaf a strong mid-

Liquor
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Liquidambar.

Liquidambar. rib runs to the extremity of each lobe that belongs to it. The flowers are of a kind of saffron colour: They are produced at the ends of the branches the beginning of April, and sometimes sooner; and are succeeded by large round brown fruit, which looks singular, but is thought by many to be no ornament to the tree. 2. The peregrinum, Canada liquidambar, or spleenwort-leaved gale, is a native of Canada and Pennsylvania. The young branches of this species are slender, tough, and hardy. The leaves are oblong, of a deep green colour, hairy underneath, and have indentures on their edges alternately very deep. The flowers come out from the sides of the branches, like the former; and they are succeeded by small roundish fruit, which seldom ripens in England.

Propagation. This may be performed either by seeds or layers; but the first method is the best. 1. We receive the seeds from America in the spring. Against their arrival, a fine bed, in a warm well sheltered place, should be prepared. If the soil is not naturally good, and inclined to be sandy, it should be wholly taken out near a foot deep, and the vacancy filled up with earth taken up a year before from a fresh pasture with the sward, and all well rotted and mixed by being often turned, and afterwards mixed with a sixth part of drift or sea-sand. A dry day being made choice of, early in March, let the seeds be sown, and the finet of this compost riddled over them a quarter of an inch deep. When the hot weather in the spring comes on, the beds should be shaded, and waterings given often, but in very small quantities, only affording them a gentle, nay, a very small sprinkling, at a time. Millar says, the seeds of these plants never come up under two years. But, continues Hanbury, with this easy management, I hardly ever knew it longer than the end of May before the young plants made their appearance. The plants being come up, shading should still be afforded them in the parching summer, and a watering every other night; and this will promote their growth, and cause them to become stronger plants by the autumn. In the autumn, the beds should be hooped to be covered with mats in the severe frosts. These mats, however, should always be taken off in open weather; and this is all the management they will require during the first winter. The succeeding summer they will require no other trouble than weeding; though, if it should prove a dry one, they will find benefit from a little water now-and-then. By the autumn they will be grown strong enough to resist the cold of the following winter, without demanding the trouble of matting, if the situation is well sheltered; if not, it will be proper to have the hoops prepared, and the mats ready, against the black northern frosts, which would endanger at least their losing their tops. After this, nothing except weeding will be wanted; and in the spring following, that is, three years from their first appearance, they should be taken up (for they should not be removed before, unless some of the strongest plants be drawn out of the bed), and planted in the nursery a foot asunder, and two feet distant in the rows. Hoeing the weeds in the rows in the summer, and digging them in the winter, is all the trouble they will afterwards occasion until they are finally planted out. 2. These plants are easily increased by layers. The operation must be performed in the autumn, on the young summer's shoots; and the best way is by slit-

ting them at a joint, as is practised for carnations. In a strong dry soil, they will be often two years or more before they strike root; though, in a fine light soil, they will be found to take freely enough. By this method good plants may be obtained; though it is not so eligible as the other, if we have the convenience of procuring the seeds.

Properties. The leaves emit their odoriferous particles in such plenty as to perfume the circumambient air; nay, the whole tree exudes such a fragrant transparent resin, as to have given occasion to its being taken for the sweet storax †. These trees, therefore, are very proper to be planted singly in large opens, that they may amply display their fine pyramidal growth, or to be set in places near seats, pavilions, &c. The resin was formerly of great use as a perfume, but is at present a stranger in the shops.

LIQUOR, a name for any fluid substance of the aqueous or spirituous kind.

The principal beverage amongst the Jews, as well as the Greeks and Romans, in their early state, was water, milk, and the juices of various plants infused therein. For a long time, under the commonwealth of Rome, wine was so scarce, that in their sacrifices to the gods the libations were made with milk only. Wine did not become common there till A.U.C. 600, when vines began to be planted.

Liquor of Flint. See CHEMISTRY, n° 1069.

Smoking Liquor of Lilavius. See CHEMISTRY, n° 810.

Mineral Anodyne Liquor of Hoffman. This is a composition of highly rectified spirit of wine, vitriolic ether, and a little of the dulcified oil of vitriol. It is made by mixing an ounce of the spirit of wine, which rises first in the distillation of ether, with as much of the liquor which is to be distilled, and afterwards by dissolving in the mixture which rises next, and which contains the ether, 12 drops of the oil which rises after the ether is passed. This has the same virtues with the ether, and is now generally disused, the pure ether being substituted in its place.

LIQUORICE. See GLYCRRHIZA.

LIRIODENDRON, the TULIP-TREE, in botany: A genus of the polyginia order, belonging to the polyandria class of plants; and in the natural method ranking under the 52d order, *Cochonate*. The calyx is triphyllous; there are nine petals; and the seeds imbricated in such a manner as to form a cone.—There is but one species, viz. the *lulipifera*, a deciduous tree, native of most part of America. It rises with a large upright trunk, branching 40 or 50 feet high. The trunk, which often attains to a circumference of 30 feet, is covered with a grey bark. The branches, which are not very numerous, of the two-years-old wood, are smooth and brown; while the bark of the summer's shoots is smoother and shining, and of a bluish colour. They are very pithy. Their young wood is green, and when broken emits a strong scent. The leaves grow irregularly on the branches, on long footstalks. They are of a particular structure, being composed of three lobes, the middlemost of which is shortened in such a manner that it appears as if it had been cut off and hollowed at the middle: The two others are rounded off. They are about four or five inches long, and as many broad. They are of two colours; their upper surface is smooth, and of a stronger green than the lower. They fall off pretty early in au-

Liquor
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Lirioden-
dron.

† See
Styrax.

Liedendron,
Lis.

turn; and the buds for the next year's shoots soon after begin to swell and become dilated, inasmuch that, by the end of December, those at the ends of the branches will become near an inch long and half an inch broad. The outward laminae of these leaf-buds are of an oval figure, have several longitudinal veins, and are of a bluish colour. The flowers are produced with us in July, at the ends of the branches: They somewhat resemble the tulip, which occasions its being called the Tulip-tree. The number of petals of which each is composed, like those of the tulip, is six; and these are spotted with green, red, white, and yellow, thereby making a beautiful mixture. The flowers are succeeded by large cones, which never ripen in England.

Propagation. This is very easy, if the seeds are good; for by these, which we receive from abroad, they are to be propagated. No particular compost need be sought for; neither is the trouble of pots, boxes, hot-beds, &c. required: They will grow exceedingly well in beds of common garden-mould, and the plants will be hardier and better than those raised with more tenderness and care. Therefore, as soon as you receive the seeds, which is generally in February, and a few dry days have happened, so that the mould will work freely, sow the seeds, covering them three quarters of an inch deep; and in doing of this, observe to lay them lengthwise, otherwise, by being very long, one part, perhaps that of the embryo plant, may be out of the ground soon, and the seed be lost. This being done, let the beds be hooped; and as soon as the hot weather and drying winds come on in the spring, let them be covered from ten o'clock in the morning till sun-set. If little rain happens, they must be duly watered every other day; and by the end of May the plants will come up. Shade and watering in the hottest summer must be afforded them, and they will afterwards give very little trouble. The next winter they will want no other care than, at the approach of it, sticking some furze-bushes round the bed, to break the keen edge of the black frosts; for it is found that the seedlings of this sort are very hardy, and seldom suffer by any weather. After they have been two years in the seed-bed, they should be taken up and planted in the nursery, a foot asunder, and two feet distant in the rows. After this, the usual nursery care of hoeing the weeds, and digging between the rows in the winter, will suffice till they are taken up for planting out.

Uses. The tulip-tree, in those parts of America where it grows common, affords excellent timber for many uses: particularly, the trunk is frequently hollowed, and made into a canoe sufficient to carry many people; and for this purpose no tree is thought more proper by the inhabitants of those parts. With us, it may be stationed among trees of forty-foot growth.

LIS or LYS (John Vander), painter of history, landscapes, and conversations, was born at Oldenburgh in 1570, but went to Harlem to place himself as a disciple under Henry Goltzius; and as he was endowed with great natural talents, he soon distinguished himself in that school, and imitated the manner of his master with great success. He adhered to the same style till he went to Italy; where, having visited Venice and Rome, he studied the works of Titian, Tintoretto, Paolo Veronese, and Domenico Fetti, so effectually, that he improved his taste and judgment, and altered

his manner entirely. He soon received marks of public approbation; and his compositions became universally admired for their good expression, for their lively and natural colouring, and the sweetness and delicacy of his pencil: although it must be acknowledged, that he could never totally divest himself of the ideas and taste peculiar to the Flemings. His subjects usually were histories taken from the sacred writings, or the representation of rural sports, marriages, balls, and villagers dancing, dressed in Venetian habits; all which subjects he painted in a small as well as a large size, with a number of figures, well designed, and touched with a great deal of delicacy. He was likewise accounted to paint naked figures admirably, with natural and elegant attitudes, and a very agreeable turn of the limbs. A capital picture of this master is, Adam and Eve lamenting the death of Abel; which is extremely admired, not only for the expression, but also for the beauty of the landscape: and in the church of St Nicholas at Venice is another of his paintings, representing St Jerom in the desert, with a pen in his hand, and his head turned to look at an angel, who is supposed to be sounding the last trumpet. The colouring [of this picture is rather too red; but it is designed in a fine style, and charmingly pencilled. The paintings of this master are very rarely to be purchased. He died in 1629.

LIS (John Vander) of Breda, historical painter, was born at Breda about the year 1661, and became a disciple of Cornelius Polemburg, whose manner he imitated with extraordinary exactness, in the tints of his colouring, his neatness of pencilling, and the choice of his subjects. There are some paintings of this master's hand, which, tho' they appear to have somewhat less freedom and lightness of touch, are nearly equal to those of Polemburg, and are frequently taken to be his. At Rotterdam, in the possession of Mr Bisschop, there is a delicate painting representing Diana in the Bath, attended by her nymphs; and his most capital performance, in England, is said to be in the possession of the Viscount Middleton. The portrait of Vander Lis, painted by himself, is in the possession of Horace Walpole, Esq; which is described by that ingenious gentleman, as being worked up equal to the smoothness of enamel.

LISBON, the capital of the kingdom of Portugal, situated in the province of Estremadura, on the banks of the river Tagus, in W. Long. 9. 25. N. Lat. 38. 25. It was anciently called *Olisippo*, *Olisippo*, and *Ulisippo*, which are supposed to be derived from the Phenician *Ulisubbo* or *Olisippo* signifying in that tongue a *pleasant bay*, such as that on which this city stands. It first became considerable in the reign of king Emmanuel; from that king it hath been the capital of the kingdom, the residence of its monarchs, the seat of the chief tribunals, and offices of the metropolitan, a noble university, and the receptacle of the richest merchandize of the East and West Indies. Its air is excellent; being refreshed by the delightful sea-breezes, and those of the Tagus. The city extends for about two miles along the Tagus; but its breadth is inconsiderable. Like old Rome, it stands on seven hills: but the streets in general are narrow and dirty, and some of them are very steep; neither are they lighted at night. The churches, in general, are very fine; but the magnificence of the chapel-royal is amazing. Here is one of the finest harbours in the world; and there were a great number

Lis.
Lisbon.

not only of fine churches and convents here, but also of other public buildings, and particularly of royal palaces, and others belonging to the grandes; but the greatest part of them, and of the city, were destroyed by a most dreadful earthquake, on Nov. 1. 1755, from which it will require a long time to recover. The inhabitants, before the earthquake, did not at most exceed 150,000. The government of it is lodged in a council, consisting of a president, six counsellors, and other inferior officers. The harbour has water enough for the largest ships, and room enough for 10,000 sail without being crowded. For its security, there is a fort at the mouth of the river, on each side, and a bar that runs across it, and is very dangerous to pass without pilots. Higher up, at a place where the river is considerably contracted, there is a fort called *Torre de Belem*, or the *Tower of Belem*, under whose guns all ships must pass in their way to the city; and on the other side are several more forts. Before the earthquake, most of the private houses were old and unsightly, with lattice-windows; and the number of convents and colleges amounted to 50, namely, 32 for monks and 18 for nuns. The king's principal palace stands on the river, and is large and commodious. Of the hospitals, that called the *Great* is obliged to receive all persons, of what degree, nation, or religion soever, without exception. At the village of Belem, near Lisbon, is a noble hospital for decayed gentlemen who have served the king, and have not wherewithal to maintain themselves. That called the *house of mercy* is also a noble charity. In the centre of the city, upon one of the highest hills, is the castle, which commands the whole, being large and ancient, and having always a garrison of four regiments of foot. The cathedral is a vast edifice of the Gothic kind, but heavy and clumsy: it contains, however, great riches, and is finely adorned within. The square called *Rosio* is large, and surrounded with magnificent buildings. The whole city is under the ecclesiastical jurisdiction of the patriarch, who was appointed in the year 1717. Here is also an archbishop, who has, or at least had before the erection of the patriarchate, a revenue of 40,000 crusades, or 6000 l. The university, which was removed for some time to Coimbra, but afterwards restored to its ancient seat, makes a considerable figure, though much inferior to that of Coimbra.

LISBURN, a town of Ireland, in the county of Antrim and province of Ulster, 73 miles from Dublin. It was burnt down about 50 years ago; but is now rebuilt in a neat and handsome manner, and has a large linen manufactory. It is seated on the river Laggan, in W. Long. 6. 20. N. Lat. 54. 31. It gives title of earl to the family of Vaughan; and it returns two members to parliament, one half of the patronage of this borough being in the earl of Hertford. Fairs held 21st of July and 5th of October.

LISEUX, a considerable town of France, in Upper Normandy, with a bishop's see. The churches and religious houses, and the bishop's palace, are all very handsome structures. It is a trading place; and is seated at the confluence of the rivers Arbeck and Gassin, in E. Long. 6. 20. N. Lat. 49. 11.

LISLE, a large, rich, handsome, and strong town of French Flanders, of which it is the capital, with a strong castle, and a citadel built by Vauban, and said Vol. X. Part I.

to be the finest in Europe, as well as the best fortified. The large square, and the public buildings, are very handsome; and they have manufactures of silks, cambrics, and camblets, as well as other stuffs, which have been brought to great perfection. It was taken by the duke of Marlborough, after three months siege and the loss of many thousands of men, in 1708; but restored to the French by the treaty of Utrecht, in consideration of their demolishing the fortifications of Dunkirk. It is seated on the river Ducle, 14 miles west of Tournay, 32 south-west of Ghent, 37 north-west of Mons, and 130 north of Paris, E. Long. 3. 9. N. Lat. 50. 38.

LISLE (Claudius de), a learned historiographer, born at Vancouleurs, in 1644. He studied among the Jesuits at Pontamousson; took his degrees in law, and afterwards applied himself intirely to the study of history and geography; and to perfect himself in those sciences went to Paris, where the principal lords of the court became his scholars, and among the rest the duke of Orleans, afterwards regent of the kingdom. He wrote, 1. An historical account of the kingdom of Siam. 2. A genealogical and historical Atlas. 3. An abridgement of universal history. He died at Paris in 1720.

LISLE (William de), son of the former, and the most learned geographer France has produced, was born at Paris in 1675. He became first geographer to the king, royal censor, and member of the academy of sciences. He died in 1726. He published a great number of excellent maps, and wrote many pieces in the memoirs of the academy of sciences.

LISLE (Sir John), a brave loyalist in the time of the civil wars, was the son of a bookseller in London, and received his education in the Netherlands. He signalized himself upon many occasions in the civil war, particularly in the last battle of Newbury; where, in the dusk of the evening, he led his men to the charge in his shirt, that his person might be more conspicuous. The king, who was an eye-witness of his bravery, knighted him in the field of battle. In 1648, he rose for his majesty in Essex; and was one of the royalists who so obstinately defended Colchester, and who died for the defence of it. This brave man having tenderly embraced the corps of Sir Charles Lucas, his departed friend, immediately presented himself to the soldiers who stood ready for his execution. "Thinking that they stood at too great a distance, he desired them to come nearer: one of them said, "I warrant you, Sir, we shall hit you." He replied with a smile, "Friends, I have been nearer you when you have missed me." He was executed August 28th 1648.

LISMORE, one of the Western islands of Scotland, seated at the mouth of Loch Linnhe, a capacious lake in Argyllshire, navigable for the largest ships to Fort William, which stands in the country called Lochaber. This island is above seven miles in length by one in breadth; and contains 1500 inhabitants. It abounds in limestone; from which, however, it has hitherto derived little advantage, owing to the want of good peat, the neglect of timber, and still more the duty upon coals. Thus, with the advantages of navigation in every direction, and of a soil lying upon the richest manure, the people are indigent, and frequently obliged to import meal for their subsistence. Many of

Lismore

them live a part of the year upon milk only. This island was formerly the residence of the bishops of Argle.

LISMORE, a borough, market, fair, and post town of Ireland, in the county of Waterford, and province of Munster, 100 miles from Dublin; N. Lat. 52. 5. W. Long. 7. 50. It was anciently called *Leshmore* or *Lios-more*, i. e. the great inclosure, or habitation; it is now a bishopric, and formerly had an university. St Carthagh or Mochuda, in the beginning of the seventh century founded an abbey and school in this place, which in a short time was much resorted to, not only by the natives, but also by the Britons and Saxons, during the middle ages. According to an ancient writer of the life of St Carthagh, Lismore was in general inhabited by monks, half of it being an asylum into which no woman dared enter; consisting intirely of cells and monasteries, the ruins of which, with seven churches, are yet visible. A castle was built here by king John. The site of Lismore was in early ages denominated *magh shia*, or the "chosen shield," being the situation of a din or fort, of the ancient chieftains of the Decies, one of whom granted it to St Carthagh on his expulsion from the abbey of Ratheny in Weitmeath. On becoming an university, Math Sgiath obtained the name of *Dunsginne*, or the "fort of the Saxons," from the number of Saxons which resorted thereto: but soon after, it was called *Lios-mor* or *Leshmore*, and now *Lismore*; the bishopric of which was united to that of Waterford in 1363, being 730 years after its foundation. The public road to Cork was formerly through this place, and at that time it had a better face of business. St Carthagh, who retired to this place with some of his religious in 636, to avoid the fury of the then Irish monarch, tied his disciples to a most strict rule of life; they never were allowed the use of flesh, fish, or fowl; only the vegetables that the ground produced at the expence of their own labour. Father Daniel, in his *Histoire Monastique*, mentions one on the same foundation in France. The castle here, which, as we have formerly mentioned, was built by king John, was erected in 1195 on the ruins of the abbey of St Carthagh; it belonged to the duke of Devonshire, and gave birth to the great philosopher Robert Boyle. In 1189 it was demolished by the Irish, who took it by surprise. Being afterwards re-edified, it was for many years an episcopal residence, till Myler Magrath, archbishop of Cashel, and bishop of this fee, granted the manor of Lismore to that noted scholar and soldier Sir Walter Raleigh, in the reign of queen Elizabeth, at the yearly rent of L. 13; 6; 8; but that estate was lopped off with his head in the reign of king James I. After which it fell into the hands of Sir Richard Boyle, who purchased all Sir Walter's lands; he beautified the whole, and added many buildings to it, most of which were burned down in the Irish rebellion; at the breaking out of which, it was closely besieged by 5000 Irish, commanded by Sir Richard Beling, and was well defended by the young Lord Broghill, third son of the earl of Cork, who obliged them to raise the siege. The castle is boldly seated on the verge of a rocky hill, rising almost perpendicularly to a considerable height over the river Blackwater. The entrance is by an ancient and venerable avenue of trees. Over the gate are the venerable arms

of the first earl of Cork. Opposite to the entrance is a modern portico of Bath stone, of the Doric order, designed by Inigo Jones. Most of the buildings have remained in ruins since the era of the rebellion; but the several offices that make up two sides of the square are kept in repair. At each angle is a tower, the chief remains of its former magnificence. In October 1785, the late duke of Rutland, then lord-lieutenant of Ireland, whilst on a tour in Munster, held a council in, and issued proclamations from this castle. The cathedral is still pretty well kept in repair. Here is a fine bridge over the river Blackwater, erected at a very great expence by the duke of Devonshire: this bridge is remarkable for the extent of the principal arch, the span of it being 102 feet. Below the town is a rich fishery for salmon, which is the greatest branch of trade here. Though this place is at present much reduced, yet Cambrensis informs us, that, not many years after the conquest, this was a very rich city, and held out some time against the English, who took it at last by storm, and gained rich plunder here, enough to load 16 sail of ships. It returns two members to parliament; patron, the duke of Devonshire, but the electors are called *potawollopers*. Fairs held on 25th May and September, and 12th November.

LISSA, an island in the Gulph of Venice, on the coast of Dalmatia, belonging to the Venetians, where they have a fishery of sardines and anchovies. It produces excellent wine, and is 70 miles west of Ragusa. E. Long. 17. 0. N. Lat. 43. 22.

LISSA, a town of Poland, in the palatinate of Pofna, of which it is the capital. E. Long. 16. 0. N. Lat. 32. 15.

LISSA, a village of Silesia, 16 miles from Breslau, remarkable for a battle fought between the Prussians and the Austrians on the 15th of December 1757, when the latter were entirely defeated.

LISSUS, (anc. geog.), the last town of Illyricum, towards Macedonia, situated on the Drilo. It had a capacious port, the work of Dionysius the Tyrant, who led the colony thither, enlarged and walled it round, (Diodorus Siculus.) Now called *Alessio*, in Albania, on the Drino, near the Gulph of Venice. E. Long. 20. N. Lat. 42.

LIST, in commerce, the border of cloth or stuff; serving not only to show their quality, but to preserve them from being torn in the operations of fulling, dyeing, &c.—List is used on various occasions; but chiefly by gardeners for securing their wall-trees.

LIST, in architecture, a little square moulding, otherwise called a *fillet*, *listel*, &c. See Plate XXXVIII. fig. 1.

LIST, is also used, to signify the inclosed field or ground wherein the ancient knights held their jousts and combats. It was so called, as being hemmed round with pales, barriers, or stakes, as with a list. Some of these were double, one for each cavalier; which kept them apart, so that they could not come nearer each other than a spear's length. See JUST, TOURNAMENT, DUEL, &c.

Civil LIST, in the British polity. The expences defrayed by the civil list are those that in any shape relate to civil government; as, the expences of the household; all salaries to officers of state, to the judges, and every one of the king's servants, the appointments to foreign

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foreign ambassadors; the maintenance of the queen and royal family; the king's private expenses, or privy-purse; and other very numerous outgoings, as secret-service money, pensions, and other bounties: which sometimes have so far exceeded the revenues appointed for that purpose, that application has been made to parliament to discharge the debts contracted on the civil list; as particularly in 1724, when one million was granted for that purpose by the statute 11 Geo. I. c. 17. and in 1769, when half a million was appropriated to the like uses by the statute 9 Geo. III. c. 34.

The civil list is indeed properly the whole of the king's revenue in his own distinct capacity; the rest being rather the revenue of the public, or its creditors, though collected and distributed again in the name and by the officers of the crown: it now standing in the same place, as the hereditary income did formerly; and as that has gradually diminished, the parliamentary appointments have increased. The whole revenue of queen Elizabeth did not amount to more than 600,000*l.* a-year: that of king Char. I. was 800,000*l.* and the revenue voted for king Charles II. was 1,200,000*l.* though complaints were made (in the first years at least) that it did not amount to so much. But it must be observed, that under these sums were included all manner of public expenses; among which Lord Clarendon, in his speech to the parliament, computed, that the charge of the navy and land-forces amounted annually to 800,000*l.* which was ten times more than before the former troubles. The same revenue, subject to the same charges, was settled on king James II.: but by the increase of trade, and more frugal management, it amounted on an average to 1,500,000*l.* *per annum*, (besides other additional customs granted by parliament, which produced an annual revenue of 400,000*l.* out of which his fleet and army were maintained at the yearly expence of 1,100,000*l.* After the revolution, when the parliament took into its own hands the annual support of the forces both maritime and military, a civil-list revenue was settled on the new king and queen, amounting, with the hereditary duties, to 700,000*l.* *per annum*; and the same was continued to queen Anne and king George I. That of king Geo. II. was nominally augmented to 800,000*l.* and in fact was considerably more: but that of his present majesty is expressly limited to that sum; tho' 100,000*l.* hath been since added. And upon the whole, it is doubtless much better for the crown, and also for the people, to have the revenue settled upon the modern footing rather than the ancient. For the crown, because it is more certain, and collected with greater ease: for the people; because they are now delivered from the feudal hardships, and other odious branches of the prerogative. And though complaints have sometimes been made of the increase of the civil list, yet if we consider the sums that have been formerly granted, the limited extent under which it is now established, the revenues and prerogatives given up in lieu of it by the crown, the numerous branches of the present royal family, and (above all) the diminution of the value of money compared with what it was worth in the last century, we must acknowledge these complaints to be void of any rational foundation; and that it is impossible to support that dignity, which a king of Great Britain should maintain, with an income in any degree

less than what is now established by parliament. See REVENUE.

To LIST, or enlist, Soldiers, to retain and enroll men as soldiers, either as volunteers, or by a kind of compulsion. Persons lifted must be carried within four days, but not sooner than 24 hours after, before the next justice of peace of any county, riding, city, or place, or chief magistrate of any city or town corporate (not being an officer in the army); and if before such justice or magistrate they dissent from such enlisting, and return the enlisting-money, and also 20 shillings in lieu of all charges expended on them, they are to be discharged. But persons refusing or neglecting to return and pay such money within 24 hours, shall be deemed as duly listed as if they had assented thereto before the proper magistrate; and they shall, in that case, be obliged to take the oath, or, upon refusal, they shall be confined by the officer who lifted them till they do take it.

LISTER (Dr Martin), an eminent English physician and naturalist, was born in 1638, and educated at Cambridge. He afterwards travelled into France; and at his return practised physic at York, and afterwards at London. In 1683, he was created doctor of physic, and became fellow of the college of physicians in London. In 1698, he attended the earl of Portland in his embassy from king William III. to the court of France; of which journey he published an account at his return, and was afterwards physician to queen Anne. He also published, 1. *Historia animalium Anglie*, quarto. 2. *Conchyliorum synopsis*, folio. 3. *Cochlearum & limacum exercitatio anatomica*, 4 vols 8vo. 4. Many pieces in the Philosophical Transactions; and other works.

LISTOWEL, a parish, also a post and fair town, of Ireland, in the county of Kerry and province of Munster, 131. miles from Dublin, anciently *Lis Tuathal*, i. e. "the fort of Tuathal," who was exiled in the 1st century, but returned; and his life forms a brilliant era in Irish history. Near this are the ruins of a castle, pleasantly situated on the river Feale: it was taken in November 1600, by Sir Charles Wilmot, being then held out for the Lord Kerry against Queen Elizabeth. Five miles beyond Listowel are the ruins of a church. The fairs are three in the year.

LITANA SILVA (anc. geog.); a wood of the Boii, in the Gallia Togata, or Cispadana, where the Romans, under L. Posthumus Albinus (whose head the Boii cut off, and carried in triumph into their most sacred temple), had a great defeat, of twenty-five thousand scarce ten escaping (Livy). Hoffenius conjectures, that this happened above the springs of the Scultenna, in a part of the Apennine, between Cersinianum and Mutina. Now *Selva di Lugo*.

LITANY, a solemn form of supplication to God, in which the priest utters some things fit to be prayed for, and the people join in their intercession, saying, *we beseech thee to hear us, good Lord, &c.* The word comes from the Greek *litanos*, "supplication" of *litanos*, "I beseech."

At first the use of litanies was not fixed to any stated time, but were only employed as exigencies required. They were observed, in imitation of the Ninevites, with ardent supplications and fastings, to avert the threatening judgments of fire, earthquakes, inundations,

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Litchfield dations, or hostile invasions. About the year 400, litany began to be used in processions, the people walking barefoot, and repeating them with great devotion; and it is pretended, that by this means several countries were delivered from great calamities. The days on which these were used were called *rogation days*: these were appointed by the canons of different councils, till it was decreed by the council of Toledo, that they should be used every month throughout the year; and thus by degrees they came to be used weekly on Wednesdays and Fridays, the ancient stationary days for fasting. To these days the rubric of our church has added Sundays, as being the greatest days for assembling at divine service. Before the last review of the common prayer, the litany was a distinct service by itself, and used some time after the morning prayer was over; at present it is made one office with the morning-service, being ordered to be read after the third collect for grace, instead of the intercessional prayers in the daily service.

LITCHFIELD, a city of Staffordshire, in England, 117 miles from London. It stands low, about three miles from the Trent; and its ancient name is said to have been *Licidfield*, signifying, "a field of carcasses," from a great number of Christians having, as it is pretended, suffered martyrdom here in the persecution under Dioclesian. In the Saxons time, it was a bishoprick for a short space; and is now, together with Coventry, a bishoprick. It is divided into two parts by a rivulet and a kind of shallow lake, over which are two causeways with sluices. It is a long straggling place; but has some very handsome houses, and well-paved clean streets. That part on the south side of the rivulet is called the *city*, and the other the *close*. The *city* is much the largest, and contains several public structures. It was incorporated by Edw. VI. with the name of bailiffs and burgesses; and is both a town and county, governed by 2 bailiffs chosen yearly out of 24 burgesses, a recorder, a sheriff, a steward, and other officers. The city has power of life and death within their jurisdiction, a court of record, and a piepowder-court. Here is a gaol both for debtors and felons, a free school, and a pretty large well endowed hospital for a master and 12 brethren. The county of the city is 10 or 12 miles in compass, which the sheriff rides yearly on the 8th of September, and then feasts the corporation and neighbouring gentry. The *close* is so called from its being inclosed with a wall and a deep dry ditch on all sides except towards the city, where it is defended by a great lake or marsh formed by its brook. The cathedral, which stands in the close, was originally built by Oswius king of Northumberland about 300. It was rebuilt and enlarged by Offa king of Mercia in 766. In 1148 was rebuilt, and greatly enlarged in 1296. At the reformation, Coventry was divided from it. In the civil wars its spire was destroyed, and it converted to a stable. In 1776 a beautiful painted window, by the benefaction of Dr Adenbrook, has been set up at the western end of the cathedral. In the civil wars it was several times taken and retaken, and thereby suffered much; but was so repaired after the restoration, at the expence of 20,000 l. that it was one of the fairest and noblest structures of the kind in England. It is walled in like a castle, and stands so high as to be seen 10 miles round.

It is 450 feet long, of which the choir is 110, and the breadth in the broadest place 80. Its portico is hardly to be paralleled in England. There were till lately 26 statues of the prophets, apostles, kings of Judah, and some kings of this land, in a row above it, as big as the life; and on the top, at each corner of the portico, is a stately spire, besides a fine high steeple on the middle of the church. The choir is paved in great part with alabaster and channel-coal, in imitation of black and white marble. In 1789 it went under a general repair, when the massive groined arch betwixt the west end of the church and the transept, which had forced the side wall out of its perpendicular, was removed. The prebendaries stalls, which are thought to be the best in England, were most of them re-erected at the charge of the country gentlemen, whose names and arms are painted at the top of the stalls. The north door is extremely rich in sculpture, but much injured by time. The body, which is supported by pillars formed of numbers of slender columns, has lately had its decayed leaden roof replaced by a neat slated covering. The choir merits attention on account of the elegant sculpture about the windows, and the embattled gallery that runs beneath them; to which the altar-piece of Grecian architecture but ill corresponds; behind which is Mary's chapel, divided from it by a most elegant stone screen of beautiful workmanship. Here stood St Chad's shrine, which cost 2000 l. The charter-house is an octagon-room. In the same close are the palaces of the bishop and dean, and the prebendaries houses in a court on the hill. Here are three other churches; one of which, St Michael's, has a church-yard of 6 or 7 acres. There was a castle here, long since destroyed: and ancient camps have been discovered in its environs. In the neighbourhood are frequent horse-races. The markets there are on Tuesday and Friday, and six fairs in the year. By the late inland navigation, this place has communication with the rivers Mersey, Dee, Ribble, Ouse, Trent, Darwent, Severn, Humber, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles in the counties of Lincoln, Nottingham, York, Lancaster, Westmoreland, Cheshire, Warwick, Leicester, Oxford, Worcester, &c. Litchfield sends two members to parliament.

LITERARY, any thing belonging to LITERATURE.

LITERARY Property, or Copy-Right. See *COPY-RIGHT*. **LITERATI** (*letrados*, "lettered"), an epithet given to such persons among the Chinese as are able to read and write their language. The literati alone are capable of being made mandarins.

LITERATI is also the name of a particular sect, either in religion, philosophy, or politics, consisting principally of the learned men of that country; among whom it is called *jukiao*, i. e. "learned."

It had its rise in the year of Christ 1400, when the emperor, to awaken the native affection of the people for knowledge, which had been quite banished by the preceding civil wars among them, and to stir up emulation among the mandarins, chose out 42 of the ablest among their doctors, to whom he gave a commission to compose a body of doctrine agreeable to that of the ancients, which was then become the rule or standard of the learned. The delegates applied themselves to

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Literati
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Lithan-
thrax.

the business with very great attention; but some fancied them rather to have wrestled the doctrine of the ancients, to make it consist with theirs, than to have built up theirs on the model of the ancients.

They speak of the Deity, as if it were no more than mere nature or the natural power or virtue that produces, disposes, and preserves, the several parts of the universe. It is, say they, a pure, perfect principle, without beginning or end; it is the source of all things, the essence of every being, and that which determines it to be what it is. They make God the soul of the world: they say, he is diffused through all matter, and produces all the changes that happen there. In short, it is not easy to determine, whether they resolve God into nature, or lift up nature into God; for they ascribe to it many of those things which we attribute to God.

This doctrine, in lieu of the idolatry that prevailed before, introduced a refined kind of atheism. The work, being composed by so many persons of learning and parts, and approved by the emperor himself, was received with infinite applause by all the people. Many were pleased with it, because it seemed to subvert all religion; others approved it, because the little religion that it left them could not give them much trouble. And thus was formed the sect of the Literati; which consists of the maintainers and adherents to this doctrine.

The court, the mandarins, and the persons of fortune and quality, &c. are generally retainers to it; but a great part of the common people still hold to their worship of idols.

The literati freely tolerate the Mahometans, because they adore, with them, the king of heaven, and author of nature; but they bear a perfect aversion to all sorts of idolaters among them; and it was once resolved to extirpate them. But the disorder this would have occasioned in the empire prevented it: they now content themselves with condemning them, in general, as heretics; which they do solemnly every year at Pekin.

LITERATURE denotes learning or skill in letters.

LITERNUM. See LINTERNUM.

LITHANTHRAX, or *Pit-Coal*, is a black or brown, laminated, bituminous substance; not very easily inflammable, but, when once inflamed, burns longer and more intensely than any other substance. Of this substance three kinds are distinguished by authors. The residuum of the first after combustion is black; the residuum of the second is spongy, and like pumice-stone; and the residuum of the third is whitish ashes. Some fossil coal, by long exposure to air, falls into a greyish powder, from which alum may be extracted. Fossil coal by distillation yields, 1. a phlegm or water; 2. a very acid liquor; 3. a thin oil like naphtha; 4. a thicker oil, resembling petroleum, which falls to the bottom of the former, and which rises with a violent fire; 5. an acid concrete salt; 6. an uninflamable earth remains in the retort. These constituent parts of fossil-coal are very similar to those of amber and other bitumens. For the exciting of intense heats, as of furnaces for smelting iron-ore, and for operations where the acid and oily vapours would be detrimental, as the drying of malt, fossil-coals are previously charged, or reduced to coaks; that is, they are made to

Litharge
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Litho-
mantia

undergo an operation similar to that by which charcoal is made. By this operation coals are deprived of their phlegm, their acid liquor, and the greatest part of their fluid oil. Coaks therefore consist of the two most fixed constituent parts, the heavy oil and the earth, together with the acid concrete salt, which the volatile is detained by the oil and earth.

LITHARGE, a preparation of lead, usually in form of soft flakes, of a yellowish reddish colour. If calcined lead be urged with a hasty fire, it melts into the appearance of oil, and on cooling concretes into litharge. Greatest part of the litharge met with in the shops is produced in the purification of silver from lead, and the refining of gold and silver by means of this metal: according to the degree of fire and other circumstances, it proves of a pale or deep colour; the first has been commonly called *litharge of silver*, the other *litharge of gold*. See CHEMISTRY-Index.

LITHGOW (William), a Scotman, whose sufferings by imprisonment and torture at Malaga, and whole travels, on foot, over Europe, Asia, and Africa, seem to raise him almost to the rank of a martyr and a hero, published an account of his peregrinations and adventures. Though the author deals much in the marvellous, the horrid account of the strange cruelties of which, he tells us, he was the subject, have, however, an air of truth. Soon after his arrival in England from Malaga, he was carried to Theobald's on a feather-bed, that King James might be an eye-witness of his *martyred anatomy*, by which he means his wretched body, mangled and reduced to a skeleton. The whole court crowded to see him; and his majesty ordered him to be taken care of, and he was twice sent to Bath at his expense. By the king's command, he applied to Gondamar, the Spanish ambassador, for the recovery of the money and other things of value which the governor of Malaga had taken from him, and for L. 1000 for his support. He was promised a full reparation for the damage he had sustained; but the perfidious minister never performed his promise. When he was upon the point of leaving England, Lithgow upbraided him with the breach of his word in the presence-chamber, before several gentlemen of the court. This occasioned their fighting upon the spot; and the ambassador, as the traveller oddly expresses it, had his fistula (with which disorder he was afflicted) contrabanded with his fist. The unfortunate Lithgow, who was generally condemned for his spirited behaviour, was sent to the Marshalsea, where he continued a prisoner nine months. At the conclusion of the octavo edition of his *Travels* he informs us, that, in his three voyages, "his painful feet have traced over (besides passages of seas and rivers) 36,000 and odd miles, which draweth near to twice the circumference of the whole earth." Here the marvellous seems to rise to the incredible; and to set him, in point of veracity, below Coryat, whom it is nevertheless certain that he far outwalked. His description of Ireland is whimsical and curious. This, together with the narrative of his sufferings, is reprinted in Morgan's *Phoenix Britannicus*.

LITHIASIS, or STONE. See MEDICINE-Index.

LITHOMANTIA, in antiquity, a species of divination performed with stones. Sometimes the stone, called *fiderius* was used: this they washed in spring-water.

water in the night by candle-light; the person that consulted it was to be purified from all manner of pollution, and to have his face covered: this done, he repeated divine prayers, and placed certain characters in an appointed order; and then the stone moved of itself, and in a soft gentle murmur, or (as some say) in a voice like that of a child, returned an answer. By a stone of this nature, Helena is reported to have foretold the destruction of Troy.

LITHONTRIPTICUS (from *λίθος* "a stone," and *τρύπτω* "to break"), an epithet for medicines that are supposed to break the stone in the bladder. Though the different stones that are generated in the human bladder require different solvents when out of the body; and though art hath not yet afforded a medicine which, when injected into the bladder, will, without injury thereto, dissolve the stone therein lodged; it cannot thence be concluded, that there are no lithontriptic medicines. It may be here observed, that one solvent affects one subject, but hath no effect on another; so a solvent may yet be met with that will destroy the stone, and not hurt the human body. The water into which the boiled white of egg dissolves will liquefy myrrh, but may be put into the human eye without causing any uneasiness.

Soap ley taken at first in small doses in broth that is freed from all its fat, succeeds in most cases which require an alkaline solvent. The patient may begin with 20 drops, and gradually increase the dose as he is able; and by repeating it three times a-day for six, eight, or twelve months, the wished for effects often follow.

LITHOPHYTA, the name of Linnæus's third order of vermes. See **ZOOLOGY**.

LITHOSPERMUM, GROWELL: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 4th order, *Asperifolia*. The corolla is funnel-shaped, with the throat perforated and naked; the calyx quinquepartite. There are several species; but the only remarkable ones are the officinale or common growwell, and the arvense or bastard alkanet. Both these are natives of Britain; the former growing in dry gravelly soil, the latter in corn-fields. The seeds of the first are reputed to be of service in calculous cases. Dr Grew says, that they have so much earth in their composition, that they effervesce with acids; but if this is the case, it must be attributed rather to an alkaline than an earthy quality.

LITHOSTROTION, in natural history, the name of a species of fossil coral, composed of a great number of long and slender columns, sometimes round, sometimes angular, jointed nicely to one another, and of a starry or radiated surface at their tops. These are found in considerable quantities in the northern and western parts of this kingdom, sometimes in single, sometimes in complex specimens. See **PLATE CC**.

LITHOSTROTON, among the Romans, was a pavement of Mosaic work, consisting of small pieces of cut marble of different kinds and colours. The *lithostrota* began to be used in the time of Sylla, who made one at Præneste in the temple of Fortune. At last they were used in private houses; and were brought to such perfection, that they exhibited most lively re-

presentations of nature, with all the exactness of the finest painting.

LITHOTOMY, in surgery, the operation of cutting for the stone. See **SURGERY**.

LITHUANIA, an extensive province of Poland. By the natives it is called *Letwa*, and has Great Poland and Russia on the west; part of Muscovy on the east; Livonia, the Baltic Sea, and part of Muscovy, on the north; Red Russia, Volhnia, and Padolia, on the south; and the Ukraine on the south-east. Its length is said to be about 360, and its breadth 340 miles; but it is much indented both ways. Lithuania was anciently over-run with wood; and there are still many forests in it, which yield a great deal of honey, wax, pitch, tar, and timber; and abound with wild boars, buffaloes, elks, wild horses, wild asses, uri, and woodcocks. The lakes are also numerous, and well-flored with fish; but the air, by reason of these forests and lakes, is said to be thick and foggy. The country produces a great deal of buck-wheat and other corn, the pastures are luxuriant, and the flocks and herds numerous: so that, notwithstanding agriculture is much neglected, provisions are exceeding cheap, but money so scarce, that 10 per cent. is the common interest. The principal nobility have large estates, and live in great pomp and splendor, generally retaining some hundreds of those that are poor, in quality of domestics. The established religion is Popery; but Lutherans, Calvinists, Jews, Turks, Greeks, and Socinians, are very numerous. Lithuania was governed by its own dukes till it was united to Poland, towards the end of the 14th century, when the great Duke Jagello married Hedwig, the dowager of Louis king of Poland and Hungary. It had even dukes after that, but they were subordinate to the king; and at this day, tho' one diet serves for both countries, yet each has its peculiar laws, customs, dialect, and privileges. In a diet held at Lublin in 1569, it was more closely united to Poland than it had been before; and it was enacted, that both countries, for the future, should form but one state under the same prince. As to their courts of justice, the tenth part of what is adjudged in all real actions goes always to the judge's box, and is immediately paid in court; and in personal actions he claims half the damages given. A nobleman is only fined for murder, as in Poland. The common people here, excepting the burghers in the royal towns, and the Germans, are slaves; and, in many places, the ignorant vulgar still retain some remains of idolatry. The poor people have only Mondays to themselves; and if their lords have occasion for them even on that day, the peasant must work for himself on Sunday. If any of them is condemned to death by his lord, he must execute himself, or suffer greater cruelty. The dialect is a language of the Slavonic; and they speak here, as in Poland, a barbarous kind of Latin. Lithuania is divided into nine palatinates. Another division is into Lithuanian properly so called, and Lithuanian Russia. Some also comprehend under it Samogitia and Courland, which is a sief of Poland.

LITMUS, or **LACMUS**, in the arts, is a blue pigment, formed from *archil*. It is brought from Holland at a cheap rate; but may be prepared by adding quick

Litter
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Littleton.

quick lime and putrified urine, or spirit of urine distilled from lime, to the archil previously bruised by grinding. The mixture having cooled, and the fluid suffered to evaporate, becomes a mass of the consistence of a paste, which is laid on boards to dry in square lumps. It is only used in miniature paintings, and cannot be well depended on, because the least approach of acid changes it instantly from blue to red. The best litmus is very apt to change and fly.

LITTER (*littera*), a kind of vehicle borne upon shafts; anciently esteemed the most easy and genteel way of carriage. Du-Cange derives the word from the barbarous Latin *litteria* "straw or bedding for beasts." Other will rather have it come from *latus* "bed;" there being ordinarily a quilt and a pillow to a litter in the same manner as to a bed.

Pliny calls the litter the *traveller's chamber*: it was much in use among the Romans, among whom it was borne by slaves kept for that purpose; as it still continues to be in the east, where it is called a *palanquin*.—The Roman *littera*, made to be borne by four men, was called *tetraphorum*; that borne by six *hexaphorum*; and that borne by eight *octaphorum*.

The invention of litters, according to Cicero, was owing to the kings of Bithynia: in the time of Tiberius they were become very frequent at Rome, as appears from Seneca; and even slaves themselves were borne in them, though never by more than two persons, whereas men of quality had six or eight.

LITTER also denotes a parcel of dry old straw put on the floor of a horse's stall for him to lie down and rest upon. When a horse comes tired into a stable, fresh litter has the virtue of making him stale immediately. This is known to be a very great advantage to a horse in a tired state; and when the litter is old and dirty, it never has any such effect upon him. If the owners knew how refreshing it is for a horse to discharge his urine on his return from labour, they would be more careful of giving them all means and occasions of it than they are. This staling after fatigue prevents those obstructions in the neck of the bladder or urinary passages which horses are too subject to. The bladder being often inflamed by the long retention of the heated urine in it, the creature is thus in danger of perishing.

LITTLE (William), an ancient English historian, known also by the name of *Gulielmus Neubrigenfis*, was born at Bridlington in the county of York, in the year 1136; and educated in the abbey of Newborough in the same county, where he became a monk. In his advanced years, he composed a history of England, in five books, from the Norman conquest to A. D. 1197; which, for veracity, regularity of disposition, and purity of language, is one of the most valuable productions of this period.

LITTLETON (Sir Thomas), judge of the common-pleas, was the eldest son of Thomas Westcote, esq; of the county of Devon, by Elizabeth, sole heiress of Thomas Littleton of Frankley in Worcestershire, at whose request he took the name and arms of that family. He was educated at one of our universities, probably at Cambridge. Thence he removed to the Inner Temple, where he became one of the readers; and was afterwards, by Henry VI. made steward or judge of the court of the palace, or marshalsea of the king's household. In 1455, the thirty-

third of that reign, he was appointed king's serjeant, and rode the northern circuit as judge of assize. In 1462, the second of Edward IV. he obtained a pardon from the crown; and, in 1466, was appointed one of the judges of the common-pleas, and rode the Northamptonshire circuit. In the year 1474 he was, with many of the first nobility, created knight of the Bath. He died in 1481; and was buried in the cathedral church of Worcester, where a marble tomb, with his statue upon it, was erected to his memory. As to his character as a lawyer, it is sufficient to inform the reader, that he was the author of the Treatise upon Tenures, on which Sir Edward Coke wrote a comment, well known by the title of *Coke upon Littleton*.

LITTLETON (Adam), descended from an ancient family in Shropshire, was born in 1627, educated at Westminster-school, and went to Oxford a student of Christ-church, whence he was ejected by the parliament visitors in 1648. Soon after, he became usher of Westminster-school, and in 1658 was made second master of Westminster-school. After the restoration he taught a school at Chelsea in Middlesex, of which church he was admitted rector in the year 1664. In 1670 he accumulated the degrees in divinity, being then chaplain in ordinary to his majesty. In 1674, he became prebendary of Westminster, of which church he was afterwards sub-dean. Beside the well-known *Latin and English Dictionary*, he published several other works. He died in 1694, and was interred at Chelsea. He was an universal scholar; and extremely charitable, humane, and easy of access.

LITURGY, denotes all the ceremonies in general belonging to divine service.

The word comes from the Greek *λειτουργία* "service, public ministry;" formed of *λειτουργ* "public," and *εργον* "work."

In a more restrained signification, liturgy is used among the Romanists to signify the *mass*; and among us the *common-prayer*.

All who have written on liturgies agree, that in the primitive days divine service was exceedingly simple, only clogged with a very few ceremonies, and consisting of but a small number of prayers; but, by degrees, they increased the number of external ceremonies, and added new prayers, to make the office look more awful and venerable to the people. At length things were carried to such a pitch, that a regulation became necessary; and it was found proper to put the service, and the manner of performing it, into writing; and this was what they called a *liturgy*.

Liturgies have been different at different times, and in different countries. We have the liturgy of St Chrysostom, that of St Peter, of St James, the liturgy of St Basil, the Armenian liturgy, the liturgy of the Maronites, of the Copts, the Roman liturgy, the Gallican liturgy, the English liturgy, the Ambrosian liturgy, the Spanish and African liturgies, &c.

In the more early ages of the church, every bishop had a power to form a liturgy for his own diocese; and if he kept to the analogy of faith and doctrine, all circumstances were left to his own discretion. Afterwards the practice was for the whole province to follow the metropolitan church, which also became the general rule of the church: and this Lindwood acknowledges

Littleton,
Liturgy.

Liturg
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Livadia.

lidges to be the common law of the church; intimating, that the use of several services in the same province, which was the case in England, was not to be warranted but by long custom. The liturgy of the church of England was composed in the year 1547, and established in the second year of King Edward VI. stat. 2. and 3 Ed. VI. cap. 1.

In the fifth year of this king it was reviewed; because some things were contained in that liturgy which shewed a compliance with the superstition of those times, and some exceptions were taken against it by some learned men at home, and by Calvin abroad. Some alterations were made in it, which consisted in adding the general confession and absolution, and the communion to begin with the ten commandments. The use of oil in confirmation and extreme unction were left out, and also prayers for souls departed, and what tended to a belief of Christ's real presence in the eucharist. This liturgy, so reformed, was established by the act of 5 and 6 Ed. VI. cap. 1. However, it was abolished by Queen Mary, who enacted, that the service should stand as it was most commonly used in the last year of the reign of King Henry VIII. The liturgy of 5 and 6 Ed. VI. was re-established with some few alterations and additions, by 1 Eliz. cap. 2. Some farther alterations were introduced, in consequence of the review of the common prayer-book, by order of King James, in the first year of his reign; particularly in the office of private baptism, in several rubrics and other passages, with the addition of five or six new prayers and thanksgivings, and all that part of the catechism which contains the doctrine of the sacraments. The book of common-prayer, so altered, remained in force from the first year of King James to the fourteenth of Charles II. But the last review of the liturgy was in the year 1661, and the last act of uniformity enjoining the observance of it is 13 and 14 Car. II. cap. 4. See *COMMON-PRAYER*. Many applications have been since made for a review, but hitherto without success.

LITUUS, among the Romans, was the staff made use of by the augurs in quattering the heavens. It bore a great resemblance to the crozier of a bishop, but was shorter. It was crooked at one end, and thickest in the curved part, according to A. Gellius. We frequently meet with a representation of it upon medals, amongst other pontifical instruments. It was called *Lituus Quirinalis*, from Quirinus, a name of Romulus, who was skilled in all the mysteries of augury.

LITRUS, was also an instrument of music in use in the Roman army. It was straight, excepting that it had a little bending at the upper end like a lituus or sacred staff of the augurs; and from the similitude it derived its name. The litrus, as an instrument of martial music, was of a middle kind, betwixt the cornu and the tuba.

LIVADIA, anciently *Achaia* and *Hellas*, or *Greece* properly so called; a province of Turkey in Europe, bounded on the north by Epirus and Thessaly, from which is separated by mount Oeta, now Banina, and by the Euripus, now the strait of Negropont; on the east, by the Archipelago; on the south, by the gulf of Engia or Egina, the isthmus of Corinth, and the N^o 183.

Livadia
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Liver.

gulf of Lepanto; and on the west, by the Ionian sea and part of Epirus. Its extent is about 130 miles from north-west to south-east; but its greatest breadth is not above 36 miles. It is in general a mountainous country; but neither unpleasant nor unfruitful. The principal mountains are, mount Oeta in Bœotia, where is the famous pass of Thermopylæ, not above 25 feet broad; and Parnassus, Helicon, and Cythæron in Phocis, which were sacred to Apollo and the muses, and consequently much celebrated by the poets. The rivers of most note are, the Sionapros, anciently the Achelous, the Cephissus, the Ifimenus, and the Afopos. The province is at present divided into Livadia proper, Stramulippa, and the duchy of Athens. The principal places are, Lepanto, anciently Naupactus; Livadia, anciently Libadia or Lebada; the celebrated city of Athens, now Setines; Thebes, now Stibes; Lepina, anciently Eleusis; Castri, formerly Delphi; and Megara.

LIVADIA, an ancient town of Turkey in Europe, and capital of a province of the same name in Greece. It is a large and populous place, seated on the gulf of Lepanto, about 25 miles from the city of that name. It has now a considerable trade in woollen stuffs and rice. Anciently it was celebrated for the oracle of Trophonius, which was in a cavern in a hill above the town. E. Long. 23. 29. N. Lat. 38. 40.

LIVER, in anatomy. See there, n^o 96.—Plato, and other of the ancients, fix the principle of love in the liver; whence the Latin proverb, *Cogit amare jecur*: and in this sense Horace frequently uses the word, as when he says, *Si torrere jecur queris Idonæum*.—The Greeks, from its concave figure, called it *σπῆν*, “ vaulted, suspended;” the Latins call it *jecur*, q. d. *juxta cor*, as being “near the heart.” The French call it *foie*, from *foyer*, *focus*, “a fire-place;” agreeable to the doctrine of the ancients, who believed the blood to be boiled and prepared in it.—Erasistratus, at first, called it *parenchyma*, i. e. *effusion*, or *mass of blood*; and Hippocrates, by way of eminence, frequently calls it the *hypochondrium*.

LIVER of Antimony. See *CHEMISTRY-Index*.

LIVER of Arsenic, is a combination of white arsenic with liquid fixed vegetable alkali, or by the humid way. Arsenic has in general a strong disposition to unite with alkalis. Mr Maquer, in his *Mémoires upon Arsenic*, mentions a singular kind of neutral salt, which results from the union of arsenic with the alkaline basis of nitre, when nitre is decomposed, and its acid is disengaged in close vessels, by means of arsenic. To this salt he has given the name of *neutral arsenical salt* †. † See *Chem. Index*. The liver of arsenic, mentioned also by that chemist, although composed, like the neutral arsenical salt, of arsenic and fixed alkali, is nevertheless very different from that salt.

The operation for making liver of arsenic is easy and simple. To strong and concentrated liquid fixed alkali, previously heated, fine powder of white arsenic must be added. This arsenic easily disappears and dissolves, and as much of it is to be added till the alkali is saturated, or has lost its alkaline properties, although it is still capable of dissolving more arsenic superabundantly. While the alkali dissolves the arsenic in this operation, it

Liver,
Liverpool.

it acquires a brownish colour, and a singular and disagreeable smell; which, however, is not the smell of pure arsenic heated and volatilized. Lastly, this mixture becomes more and more thick, and at length of a gluey consistence. This matter is not crystallizable as the neutral arsenical salt is. It is easily decomposed by the action of fire, which separates the arsenic. This does not happen to the arsenical salt. Any pure acid is capable of separating arsenic from the liver of arsenic, in the same manner as they separate sulphur from liver of sulphur: whereas the neutral arsenical salt cannot be decomposed but by means of the united affinities of acids and metallic substances. Thus we see that arsenic may be combined with fixed alkali in two very different manners.

The author has given to this combination the name of *liver of arsenic*, to distinguish it from the neutral arsenical salt, and in imitation of the name of the *liver of sulphur*, given to the combination of the fixed alkali with sulphur.

LIVER of Sulphur. See CHEMISTRY, Index.

LIVER-Wort, in botany. See MARCHANTIA and LICHEN.

LIVER-Stone, (lapis hepaticus); a genus of inflammable substances, containing, besides its phlogiston, argillaceous, ponderous, and siliceous earth, united with vitriolic acid. See EARTHS, §. 1. n. 4.

Mr Bergman, in his *Sciagraphia*, informs us, that 100 parts of this stone contain 33 of siliceous earth, 29 of caustic ponderous earth, almost 5 of argillaceous earth, and 3.7 of lime, besides the vitriolic acid and water of crystallization: but Mr Kirwan quotes another analysis of the same author, where it is said that 100 parts of it contain 33 of baro-felenite, 38 of siliceous earth, 22 of alum, 7 of gypsum, and 5 of mineral oil.

LIVERPOOL, a large, flourishing, and populous town of England, in the county of Lancaster, situated at the influx of the river Mersey into the sea. This town has so much increased in trade since the commencement of the present century, that it is now the greatest sea-port in England except London, having exceeded Bristol considerably of late years; which will appear by the following account of the custom-duties, received in the several ports of London, Liverpool, and Bristol, in the year 1784, taken from the report of the commissioners for inspecting the state of public accounts.

London,	-	-	-	L. 5,187,052	9	5 $\frac{1}{2}$
Liverpool,	-	-	-	640,684	2	2 $\frac{1}{2}$
Bristol,	-	-	-	334,909	19	3 $\frac{1}{2}$

Liverpool exceeded Bristol, L. 3,57,774 2 11

The following shows how much the trade has increased since the above period:

Duties received in the port of Liverpool from July 5th 1787, to October 11th 1787. L. 298,361 9 10 $\frac{1}{2}$. The merchants here trade to all parts of the world except Turkey and the East Indies; but the most beneficial trade is to Guinea and the West Indies, by which many of them have acquired very large fortunes.

Liverpool, during the last war, carried on more foreign trade than any town in England; and such is the

state of it at this time, that there are near three thousand vessels cleared from that port in one year to different parts of the world. Here are several manufactories for China-ware, and pot-houses which make very fine ware, some salt-works, glass-houses, and upwards of 50 breweries, from some of which large quantities of malt-liquor are sent abroad. Many of the buildings are formed in the most elegant manner; but the old streets are narrow; which defect will soon be removed, as the corporation have lately obtained an act of parliament for the improvement of the town, which they have already begun to put in force with great spirit, having taken down the principal streets in the centre of the town, and rebuilt them in a spacious and most magnificent manner; so that in a few years it will be one of the handsomest towns in England. This town contains ten churches, namely, St Peter's, St Nicholas's, St George's, St Thomas's, St Paul's, St Ann's, St John's, St James's, St Catharine's, and St Mary's. There are also meetings for independents, anabaptists, quakers, methodists, and presbyterians. The exchange is a noble structure, built of white stone in the form of a square, and round it are piazzas where the merchants assemble to transact business. Above it are the mayor's offices, the sessions-hall, the council-chamber, and two elegant ball-rooms. The expence of erecting this building amounted to L. 30,000. The custom-house is situated at the head of the old dock, and is a handsome and convenient structure. Here are many charitable foundations, among which is an excellent grammar-school well endowed, and many of the youth taught in it have exhibitions in the universities. The infirmary is a large edifice of brick and stone, situated on a hill in a very pleasant airy situation, at one end of the town.

In the town is a charity-school supported by voluntary subscriptions and contributions for 50 boys and 12 girls, who are not only clothed and educated, but also provided with food and lodging: likewise several alms houses for the widows of seamen; and an excellent poor-house, superior to any in the kingdom, where upwards of 800 men, women, and children, are supported, many of whom are employed in spinning cotton and wool. There are five large wet docks, three dry docks, and several graving docks for the repairing of shipping; which renders it the most commodious sea-port in the world. The quays which bound these docks are covered with warehouses; which is a convenience that enables the merchant to discharge his ship at a very small expence. The new prison lately finished is a noble edifice, being built entirely on the plan of the great and benevolent Mr Howard, for solitary confinement; and is perhaps the most convenient, airy, magnificent building of the kind in Europe; being upon a very extensive scale.

Liverpool received its charter from king John: it is under the government of a recorder, mayor, and an unlimited number of aldermen, two bailiffs, and a common-council of forty of the principal inhabitants, with a town-clerk and other proper officers. The town has a weekly market on Saturday, and is distant from London 204 miles. The progressive rise of population

Liverpool, tion in Liverpool, may be conceived by perusing the following table:

Year.	Christened.	Buried.	Married.
1660	3	—	—
1680	106	51	5
1700	132	124	35
1720	410	293	58
1740	485	668	137
1760	986	599	408
1780	1769	1544	606
1787	2267	1773	804

By the late inland navigation, Liverpool has communication with the rivers Dee, Ribble, Ouse, Trent, Darwent, Severn, Humber, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles, in the counties of Lincoln, Nottingham, York, Westmoreland, Chester, Stafford, Warwick, Leicester, Oxford, Worcester, &c. The Mersey, upon which the town is situated, abounds with salmon, cod, flounders, turbot, plaice, and smelts; and at full sea it is above two miles over. In the neighbourhood are frequent horse-races, on a five-mile course, the finest for the length in England. The soil in and near the town is dry and sandy, and particularly favourable to the growth of potatoes, on which the farmers often depend more than on wheat or any other grain. Fresh water is brought into the town by pipes, from some springs four miles off, pursuant to an act of parliament in the reign of Queen Anne. Liverpool sends two members to parliament.

LIVERY, in matters of dress and equipage, a certain colour and form of dress, by which noblemen and gentlemen choose to distinguish their servants.

Liveries are usually taken from fancy, or continued in families by succession. The ancient cavaliers, at their tournaments, distinguished themselves by wearing the liveries of their mistresses: thus people of quality make their domestics wear their livery.

Father Menestrier, in his *Treatise of Carousals*, has given a very ample account of the mixtures of colours in liveries. Dion tells us, that Oenomaus was the first who invented green and blue colours, for the troops which, in the circus, were to represent land and sea-fights.

The Romish church has also her several colours and liveries; white, for confessors and virgins, and in times of rejoicing; black, for the dead; red, for the apostles and martyrs; blue or violet, for penitents; and green, in times of hope.

Formerly, great men gave liveries to several, who were not of their family or servants, to engage them in their quarrels for that year; but this was prohibited by the statutes 1 Rich. II. 1 Hen. IV. cap. 27. 2 and 7 Hen. IV. 8 Hen. VI. cap. 4. 8 Ed. IV. cap. 2; and no man, of whatever condition, was allowed to give any livery, but to his domestic officers, and council learned in the law. However, most of the above statutes are repealed by 3 Car. I. cap. 4.

Livest of Selfin, in-law, signifies delivering the

possession of lands, &c. to him who has a right to Livest. Livius.

LIVERYMEN of London, are a number of men chosen from among the freemen of each company. Out of this body the common-council, sheriff, and other superior officers for the government of the city, are elected; and they alone have the privilege of giving their votes for members of parliament, from which the rest of the citizens are excluded.

LIVIVS (Titus), the best of the Roman historians, as he is called by Mr Bayle, was born at Patavium, or Padua. Few particulars of his life have been handed down to us. Coming to Rome, he acquired the notice and favour of Augustus, and there he long resided. Some have supposed, (for there is not any proof of it), that he was known to Augustus before, by certain Philosophical Dialogues which he had dedicated to him. Seneca says nothing of the dedication; but mentions the dialogues, which he calls historical and philosophical; and also some books, written purposely on the subject of philosophy. Be this as it will, it is probable that he began his history as soon as he was settled at Rome; and he seems to have devoted himself so entirely to the great work he had undertaken, as to be perfectly regardless of his own advancement. The tumults and distractions of Rome frequently obliged him to retire to Naples; not only that he might be less interrupted in the pursuit of his destined task, but also enjoy that retirement and tranquillity which he could not have at Rome, and which yet he seems to have much sought after: for he was greatly disatisfied with the manners of his age, and tells us, that "he should reap this reward of his labour, in composing the Roman history, that it would take his attention from the present numerous evils, at least while he was employed upon the first and earliest ages." He used to read parts of this history, while he was composing it, to Mæcenas and Augustus; and the latter conceived so high an opinion of him, that he pitched upon him to superintend the education of his grandson Claudius, who was afterwards emperor. After the death of Augustus, Livy returned to the place of his birth, where he was received with all imaginable honour and respect; and there he died, in the fourth year of the reign of Tiberius, aged above seventy. Some say, he died on the same day with Ovid: it is certain that he died the same year.

Scarce any man was ever more honoured, alive as well as dead, than this historian. Pliny the younger relates, that a native gentleman travelled from Gades, in the extremest parts of Spain, to see Livy; and, though Rome abounded with more stupendous and curious spectacles than any city in the world, yet he immediately returned; as if, after having seen Livy, nothing farther could be worthy of his notice. A monument was erected to this historian in the temple of Juno, where was afterwards founded the monastery of St Justina. There, in 1413, was discovered the following epitaph upon Livy: *Ossa Titi Livii Patavini, omnium mortalium judicio digni, cujus prope invictio calamo invidi populi Romani res gesta conscriberentur*; that is, "The bones of Titus Livius of Patavium, a man worthy to be approved by all mankind, by whose almost invincible pen the acts and exploits of the invincible Romans

Livius. mans were written." These bones are said to be preserved with high reverence to this day, and are shown by the Paduans as the most precious remains. In 1451, Alphonsus, king of Arragon, sent his ambassador, Anthony Panormita, to desire of the citizens of Padua the bone of that arm with which this their famous countryman had written his history: and, obtaining it, caused it to be conveyed to Naples with the greatest ceremony as a most invaluable relic. He is said to have recovered from an ill state of health by the pleasure he found in reading this history: and therefore, out of gratitude, put upon doing extraordinary honours to the memory of the writer. Panormita also, who was a native of Palermo in Sicily, and one of the ablest men of the 15th century, sold an estate to purchase this historian.

The history of Livy, like other great works of antiquity, is transmitted down to us exceedingly mutilated and imperfect. Its books were originally an hundred and forty-two, of which are extant only thirty-five. The epitomes of it, from which we learn their number, all remain, except those of the 136th and 137th books. Livy's books have been divided into decades, which some will have to have been done by Livy himself, because there is a preface to every decade; while others suppose it to be a modern contrivance, since nothing about it can be gathered from the ancients. The first decade, beginning with the foundation of Rome, is extant, and treats of the affairs of 460 years. The second decade is lost; the years of which are seventy-five. The third decade is extant, and contains the second Punic war, including eighteen years. It is reckoned the most excellent part of the history, as giving an account of a very long and sharp war, in which the Romans gained so many advantages, that no arms could afterwards withstand them. The fourth decade contains the Macedonian war against Philip, and the Asiatic war against Antiochus, which takes up the space of about 23 years. The five first books of the fifth decade were found at Worms, by Simon Gryneus, in 1431, but are very defective; and the remainder of Livy's history, which reaches to the death of Drusus in Germany in 746, together with the second decade, are supplied by Freinhemius.

Never man perhaps was furnished with greater advantages for writing a history than Livy. Besides his own great genius, which was in every respect admirably formed for the purpose, he was trained as it were in a city, at that time the empress of the world, and in the politest reign that ever was; having scarcely had any other school than the court of Augustus. He had access to the very best materials, such as the Memoirs of Sylla, Cæsar, Labienus, Pollio, Augustus, and others, written by themselves. "What writers of memorials (says Lord Bolingbroke), what compilers of the *Matéria Historica*, were these! What genius was necessary to finish up the pictures that such masters had sketched! Rome afforded men that were equal to the task. Let the remains, the precious remains, of Salust, of Livy, and of Tacitus, witness this truth. — What a school of public and private virtue had been opened to us at the resurrection of learning, if the latter historians of the Roman commonwealth, and the first of the succeeding monarchy, had come down to us entire! The few that are come down, though broken and imperfect, compose the best body of history that

we have; nay, the only body of ancient history that deserves to be an object of study. It fails us indeed most at that remarkable and fatal period, where our reasonable curiosity is raised the highest. Livy employed forty-five books to bring his history down to the end of the sixth century, and the breaking out of the third Punic war: but he employed ninety-five to bring it down from thence to the death of Drusus; that is, through the course of 120 or 130 years. Appian, Dion Cassius, and others, nay, even Plutarch included, make us but poor amends for what is lost of Livy." Speaking then of Tully's orations and letters, as the best adventitious helps to supply this loss, he says, that "the age in which Livy flourished, abounded with such materials as these: they were fresh, they were authentic: it was easy to procure them; it was safe to employ them. How he did employ them in executing the second part of his design, we may judge from his execution of the first; and, I own, I should be glad to exchange, if it were possible, what we have of this history for what we have not. Would you not be glad, my lord, to see, in one stupendous draught, the whole progress of that government from liberty to servitude; the whole series of causes and effects, apparent and real, public and private?" &c.

The encomiums bestowed upon Livy, by both ancients and moderns, are great and numerous. He not only entertains like Herodotus; he also instructs and interests in the deepest manner. But the great probity, candour, and impartiality, are what have distinguished Livy above all historians; for neither complaisance to the times, nor his particular connections with the emperor, could restrain him from speaking well of Pompey; so well, as to make Augustus call him a *Pompeian*. This we learn from Crematius Cordus, in Tacitus; who relates also, much to the emperor's honour, that this gave no interruption to their friendship. But whatever eulogies Livy may have received as an historian, he has not escaped censure as a writer. In the age wherein he lived, Asinius Pollio charged him with Patavinity; which Patavinity has been variously explained by various writers, but is generally supposed to relate to his style. The most common is, that this noble Roman, accustomed to the delicacy of the language spoken in the court of Augustus, could not bear with certain provincial idioms, which Livy, as a Paduan, used in divers places of his history. Pignorius is of another mind, and believes that this Patavinity regarded the orthography of certain words, wherein Livy used one letter for another, according to the custom of his country, writing *sibi* and *quæle* for *sibi* and *quasi*; which he attempts to prove by several ancient inscriptions. The expressions, however, or the orthography of words, are not loaded with obscurity, and the perfect classic is as familiarly acquainted with those supposed provincialisms as with the purest Latinity. — Livy has been censured too, and perhaps with justice, for being too credulous, and burdening his history with vulgar notions and superstitious tales. He may disgust when he mentions that milk and blood were rained from heaven, or that an ox spoke or a woman changed her sex; yet he candidly confesses that he recorded only what made an indelible impression upon the minds of a credulous age.

Is it worth while to mention here the capricious

Livius.

and tyrannic humour of the emperor Caligula, who accused Livy of being a negligent and wordy writer, and resolved therefore to remove his works and statues out of all libraries, where he knew they were curiously preserved? Or the same humour in Domitian, another prodigy of nature, who put to death Metius Pomponianus, because he made a collection of some orations of kings and generals out of Livy's history? Pope Gregory the Great, also, would not suffer Livy in any Christian library, because of the Pagan superstition wherewith he abounded: but the same reason held good against all ancient authors; and indeed Gregory's zeal was far from being levelled at Livy in particular, the pontiff having declared war against all human learning.

Though we know nothing of Livy's family, yet we learn from Quintilian, that he had a son, to whom he addressed some excellent precepts in rhetoric. An ancient inscription speaks also of one of his daughters, named *Livia Quaria*: the same, perhaps, that espoused the orator Lucius Magius, whom Seneca mentions; and observes, that the applauses he usually received from the public in his harangues, were not so much on his own account, as for the sake of his father in law.

Our author's history has been often published with and without the supplement of Freinsheimius. The best editions are, that of Gronovius, *cum notis variorum & suis*, Lugd. Bat. 1679, 3 vol. 8vo; that of Le Clerc, at Amsterdam, 1709, 10 vol. 12mo; and that of Crevier, at Paris, 1735, 6 vol. 4to. These have the supplements.—Learning perhaps never sustained a greater loss, in any single author, than by the destruction of the latter and more interesting part of Livy. Several eminent moderns have indulged the pleasing expectation that the entire work of this noble historian might yet be recovered. It has been said to exist in an Arabic version: and even a complete copy of the original is supposed to have been extant as late as the year 1631, and to have perished at that time in the plunder of Magdeburgh. The munificent patron of learning, Leo X. exerted the most generous zeal to rescue from oblivion the valuable treasure, which one of his most bigotted predecessors, above mentioned, had expelled from every Christian library. Bayle has preserved, under the article Leo, two curious original letters of that pontiff, concerning his hopes of recovering Livy; which afford most honourable proofs of his liberality in the cause of letters.—A lately discovered fragment of Livy's history was published in 1773 by Dr Bruns.

LIVIVS (Andronicus), a comic poet who flourished at Rome about 240 years before the Christian era. He was the first who turned the personal satyrs and scencenine verses, so long the admiration of the Romans, into the form of a proper dialogue and regular play. Though the character of a player, so valued and applauded in Greece, was reckoned vile and despicable among the Romans, Andronicus acted a part in his dramatical compositions, and engaged the attention of his audience, by repeating what he had laboured after the manner of the Greeks. Andronicus was the freedman of M. Livius Salinator, whose children he educated. His poetry was grown obsolete in the age

of Cicero, whose nicety and judgment would not even recommend the reading of it.

LIVONIA, a large province of the Russian empire, with the title of a duchy. It is bounded on the north by the gulph of Finland, on the west by that of Riga, on the south by Courland, and on the east, partly by Plescow, and partly by Novogorod. It is about 250 miles from north to south, and 150 from east to west. The land is so fertile in corn, that it is called the *granary of the north*; and would produce a great deal more, if it was not so full of lakes. The fish that abound here are salmon, carps, pikes, flat fish, and many others. In the forests there are wolves, bears, elks, rein-deer, stags, and hares. The domestic animals are very numerous; but the sheep bear very bad wool. Here are a great number of forests, which consist of birch-trees, pines, and oaks; and all the houses of the inhabitants are built with wood. The merchandizes which they send abroad are flax, hemp, honey, wax, leather skins, and potashes. The Swedes were formerly possessed of this province, but were obliged to abandon it to the Russians after the battle of Pultowa; and it was ceded to them by the peace of the North, concluded in 1722, which was confirmed by another treaty in 1742. It is divided into two provinces, viz. Letonia and Estonia; and two islands called *Oesel* and *Dagbo*, which are again subdivided into several districts.

LIVONICA-TERRA, a kind of fine bone used in the shops of Germany and Italy. It is found in Livonia, from whence it takes its name, and also in some other parts of the world. It is generally brought to us in little cakes, sealed with the impression of a church and an escutcheon, with two cross keys.

LIVRE, a French money of account, containing 20 sols. See *Monet-Table*.

LIXA, or LIXUS (anc. geog.) a town on the Atlantic near the river Lixus; made a Roman colony by Claudius Cæsar; famous in mythology for the palace of Anteus and his encounter with Hercules, (Pliny). Now *Larache*, sixty-five leagues to the south of the straits of Gibraltar.

LIXIVIOUS, an appellation given to salts obtained from burnt vegetables by pouring water on their ashes.

LIXIVIUM, in pharmacy, &c. a ley obtained by pouring some liquor upon the ashes of plants; which is more or less powerful, as it has imbibed the fixed salts contained in the ashes.

LIXNAW, a barony in the county of Kerry and province of Munster in Ireland, which gives title of Baron to the earls of Kerry; the village here of this name being their ancient seat, where the castle was erected. This seat stands agreeably on the river Brick, which is here cut into several pleasant canals, that adorn its plantations and gardens; the improvements are extensive, most of the viætes and avenues terminating by different buildings, seats, and farm-houses. The tide flows up to the gardens, whereby boats of a considerable burden may bring up goods to the bridge near the house: here are two stone-bridges over the Brick, the oldest of which was built by Nicholas the third baron Lixnaw, who was the first person that made causeways to this place, the land being naturally

Livonia
||
Lixnaw.

Lizard wet and marshy. W. Long. 9. 15. N. Lat. 52.

15.

LIZARD, in zoology. See **LACERTA**.

LIZARD, in geography, a cape or promontory of Cornwall, situated, according to the most common computation, in W. Long. 5. 47. N. Lat. 49. 50.

LLANDAFF. See **LANDAFF**.

LLOYD (Nicholas), a learned English writer in the 17th century, was born in Flintshire in England, and educated at Wadham college, Oxford. He was rector of Newington St Mary near Lambeth in Surry, till his death, which happened in 1680. His *Dictionarium Historicum* is a valuable work, to which Hoffman and Moreri are greatly indebted.

LLOYD (William), a most learned English writer and bishop, was born in Berkshire in England in 1627. He was educated under his father, rector of Sonning, and vicar of Tyle-hurst in Berkshire; then went to Oxford, and took orders. In 1660 he was made prebendary of Rippon; and in 1666 chaplain to the king. In 1667 he took the degree of doctor of divinity; in 1672 he was installed dean of Bangor; and in 1680 was consecrated bishop of St Asaph. He was one of the six bishops who, with archbishop Sancroft, were committed prisoners to the Tower of London, for subscribing a petition to the king against distributing and publishing his declaration for liberty of conscience. Soon after the revolution he was made almoner to king William and queen Mary: in 1692 he was translated to the bishopric of Litchfield and Coventry; and in 1699, to the see of Worcester, where he sat till his death, which happened in 1717, the 91st year of his age. Dr Burnet gives him an exalted character, and his works are highly esteemed.

LOACH, in ichthyology. See **COBITIS**.

LOAD, or **LODS**, in mining, a word used especially in the tin-mines, for any regular vein or course, whether metallic or not; but most commonly load means a metallic vein.

It is to be observed, that mines in general are veins or cavities within the earth, whose sides receding from or approaching to each other, make them of unequal breadths in different places, sometimes forming large spaces, which are called *bols*; these holes are filled like the rest with substances, which, whether metallic, or of any other nature, are called *loads*. When the substances forming these loads are reducible to metal, the loads are by the English miners said to be alive, otherwise they are termed dead loads.

In Cornwall and Devonshire the loads all hold their course from eastward to westward, tho' in other parts of England they frequently run from north to south. The miners report, that the sides of the load never bear in a perpendicular, but always overhang either to the north or south above. The mines seem to have been so many channels through which the waters pass within the earth; and like rivers they have their small branches opening into them in all directions: these are by the miners termed the feeders of the load. Most mines have streams of water running through them; and when they are found dry, it seems owing to the water having changed its course, which it seems sometimes to have been compelled to by the load's having filled up the course, and sometimes to have fallen into other more easy channels.

The load is frequently intercepted by the crossing of

a vein of earth or stone, or some other metalline substance; in which case it generally happens, that one part of the load is moved to a considerable distance on one side. This transient load is, by the miners, termed a *floaking*; and the part of the load which is moved, is by them said to be *heaved*. This fracture or heave of a load, according to Mr Price, is produced by a subsidence of the strata from their primary positions, which he supposes to have been horizontal or parallel to the surface of the earth, and therefore should more properly be called a depression than a heave. This heaving of the load would be an inexpressible loss to the miner, did not experience teach him, that as the loads always run on the sides of the hills, so the part heaved is always moved toward the descent of the hill; so that the miner, working toward the ascent of the hill, and meeting a floaking, considers himself as working in the heaved part; wherefore, cutting through the floaking, he works upon its back up the ascent of the hill, till he recovers the load, and *vice versa*.

LOAD is also used for nine dishes of ore, each dish being about half a hundred weight.

LOADSTONE. See **MAGNET**.

LOAMS, in natural history, are defined to be earths composed of dissimilar particles, stiff, dense, hard, and rough to the touch; not easily broke while moist, readily diffusible in water, and composed of sand and a tough viscid clay. Of these loams some are whitish and others brown and yellow.

LOAN, any thing given to another, on condition of return or payment.

Public Loans. See **FUNDS**, and **NATIONAL Debt**.

LOANDA, a province of the kingdom of Angola in Africa. It is an island about 15 miles in length, and three in breadth; remarkable chiefly for the capital of Angola situated upon it, in E. Long. 12. 25. S. Lat. 8. 45. This town was built by the Portuguese in 1578, under the direction of the first Portuguese governor in these parts. It is large, populous, and pleasantly seated on the declivity of a hill near the sea-coast, and facing the south-west. The island is supplied with fresh water from wells dug in it; and which are not sunk below the depth of three feet when they are filled with excellent water. It is remarkable, however, that the water of these wells continues good only during the time of high-tide; for, as that sinks, the water becomes more and more brackish, till at last it is quite salt, almost as much as the sea itself. On the coast of this island are fished the zimbis, or shells used in several parts of Africa instead of money; and with these shells, instead of coin, is carried on a great part of the traffic of this country.

LOANGO, a kingdom of Africa, extending itself about 180 geographical miles in length from south to north; that is, from cape St Catharine under the second degree of south latitude, to a small river called *Lovanda Louisa*, on the 5th degree of the same. From west to east it extends from Cape Negro on the coast of Ethiopia towards the *Buchumalean* mountains, so called on account of their vast quantity of ivory and great droves of elephants, about 300 miles. It is divided into four principal provinces, viz. those of Lovangiri, Loango-mongo, Chilongo, and Piri.

The inhabitants are very black, well-shaped, and of a mild-temper. The men wear long petticoats, from the waist downwards, and have round their waist a

Load

Loango.

Laango

||

Lobelia.

piece of cloth half an ell or a quarter broad, over which they wear the skin of a leopard, or some other wild beast, hanging before them like an apron. On their head they wear a cap made of grass, and quilted, with a feather a-top of it; and on their shoulder, or in their hand, they carry a buffalo's tail, to drive away the muskettoes. The womens petticoats are made only of straw, about an ell square, with which they cover their privities, but leave the greatest part of their thighs and buttocks bare: the rest of their body is quite bare, except that on their legs they wear little fringes of beads made of shells, and small bracelets of ivory on their arms. They anoint themselves with palm-oil, mixed with a kind of red wood reduced to powder.

This country abounds with poultry, oxen, cows, sheep, goats, elephants, tigers, leopards, civet-cats, and other animals; so that here are great quantities of elephants teeth, and fine furs, to be traded for.

The capital city, where the king resides, is called *Laango*, or *Banza-Laogeri*, and, in the language of the negroes, *Boarie*. This city is situated in South Lat. 4½ degrees, a league and a half from the seacoast. It is a pretty large city, shaded and adorned with bananas, palm, and other trees. The king, who resides in a large palace in the middle of it, has about 1500 concubines. If any of them is surprised in adultery, she and her paramour are instantly conveyed to the top of a very high hill, whence they are hurled down headlong from the steepest place.

Every man marries as many wives here as he pleases, who are obliged to get their husbands a livelihood, as is the practice all along the African coast inhabited by blacks. The women, therefore, cultivate the land, sow and reap, while the lazy husbands loiter away their time in idleness.

The king's revenue consists in elephants teeth, copper, and a kind of petticoats made of palm-tree leaves, and called *lavogus*: he has whole store-houses full of these *lavogus*; but his greatest riches consist in slaves of both sexes.

LOBBY, in architecture, is a small hall or waiting-room: it is also an entrance into a principal apartment, where there is a considerable space between that and a portico or vestibule, and the length or dimensions will not allow it to be considered as a vestibule or an antiroom. See ANTICHAMBER.

LOBE, in anatomy, any fleshy protuberant part, as the lobes of the lungs, the lobes of the ears, &c.

LOBELIA, CARDINAL-FLOWER: A genus of the monogamia order, belonging to the syngenesia class of plants; and in the natural method ranking under the 29th order, *Campnaceae*. The calyx is quinquefid; the corolla monopetalous, and irregular; the capsule inferior, bilocular, or trilocular. There is a great number of species, but only four of them are cultivated in our gardens; two of which are hardy herbaceous plants for the open ground, and two shrubby plants for the stove. They are all fibrous rooted perennials, rising with erect stalks from two to five or six feet high, ornamented with oblong, oval, spear-shaped, simple leaves; and spikes of beautiful monopetalous, somewhat ringent, five-parted flowers, of scarlet, blue, and violet colours. They are easily propagated by seeds, offsets, and cuttings of their stalks. The tender kinds require

the common treatment of other exotics. They are natives of America; from which their seeds must be procured.

The root of a species called the *siphilitica* is an article of the materia medica. This species grows in moist places in Virginia, and bears our winters. It is perennial, has an erect stalk three or four feet high, blue flowers, a milky juice, and a rank smell. The root consists of white fibres about two inches long, resembles tobacco in taste, which remains on the tongue, and is apt to excite vomiting. It is used by the North American Indians as a specific in the venereal disease. The form is that of decoction; the dose of which is ordered to be gradually increased till it bring on very considerable purging, then to be intermitted for a little, and again used in a more moderate degree till the cure be completed. The ulcers are also washed with the decoction, and the Indians are said to sprinkle them with the powder of the inner bark of the spruce tree. The same strictness of regimen is ordered as during a salivation or mercurial course. The benefit to be derived from this article has not, as far as we know, been confirmed either in Britain or by the practitioners in Virginia: for there, as well as in this country, recourse is almost universally had to the use of mercury; and it is probably from this reason that the London college have not received it into their list. It, however, seems to be an article which, in some cases at least, deserves a trial.

LOBETUM, anciently a town of the Hither Spain: said to have been built by the Libyan Hercules, (Pliny.) Now *Albarazin*, a town of Arragon on the confines of New Castile, on the river Guadalquivir. E. Long. 2. N. Lat. 40. 40.

LOBINEAU (Guy Alexis), a Benedictine monk, born at Renne in 1666, spent his whole life in the study of history, and the writing of several works; the principal of which are, *The history of Brittany*, 2 vols folio; and *A continuation of Felibien's history of Paris*, 9 vols folio. He died in 1727.

LOBO (Rodriguez Francis), a celebrated Portuguese poet, was born at Leiria, a small town of Estramadura. He wrote an heroic poem, some eclogues, and a piece intitled *Euphrosyne*, which is the favourite comedy of the Portuguese. His works were collected and printed together in Portuguese in 1721, in folio. He flourished about 1610.

LONO (Jerome), a famous Portuguese Jesuit, born at Lisbon, went into Ethiopia, and dwelt there for a long time. At his return he was made rector of the college of Coimbra, where he died in 1678. He wrote *An historical account of Abyssinia*, which is by some esteemed a very accurate performance.

LOBSTER, in zoology, a species of cancer. See CANCER.

LOCAL, in law, something fixed to the freehold, or tied to a certain place: thus, real actions are local, since they must be brought in the country where they lie; and local customs are those peculiar to certain countries and places.

LOCAL Medicines, those destined to act upon particular parts; as fomentations, epithems, vesicatories, &c.

LOCARNO, a town of Switzerland, capital of a bailiwick of the same name, seated at the north end

Lobetum

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Locarno.

Locatellus of the lake Maggiore, near the river Magie. It carries on a great trade; and the country abounds in pastures, wine, and fruits. E. Long. 8. 41. N. Lat. 46. 6.

LOCATELLUS's BALSAM. See PHARMACY-Index.

LOCHABER, a district of the shire of Inverness in Scotland. It is bounded by Moydart on the west, Glengary on the north, Badenoch on the east, and Lorn on the south. It derives its name from the lake or loch Aber; and extends about 20 miles from east to west, and 30 from north to south. The country is barren, bleak, mountainous, and rugged. In one of the most barren parts of this country, near the mouth of the river Aber, in the centre between the West and North Highlands, stands Fort-William, with the town of Maryburgh, built upon a navigable arm of the sea, not far from the foot of a very high mountain, called *Benevis*. The town, designed as a sutler for the garison, was erected into a borough; and the fort itself was designed as a check upon the clan Cameron, who had been guilty of depredations and other irregularities. It is inhabited mostly by the Macdonalds, Camerons, and Mackintoshes; who are not the most civilized people in Scotland, though their chiefs are generally persons of education, honour, and hospitality. Macdonald of Glengary, descended in a straight line from Donald of the Isles, possessed a feat or castle in this district, which was burnt to the ground; and destroyed in the year 1715, in consequence of his declaring for the Pretender. The elegant house and gardens belonging to Cameron of Lochiel underwent the same fate, for the same reason, after the extinction of the rebellion in the year 1746. The cadets of these families, which have formed a kind of inferior gentry, are lazy, indigent, and uncleanly; proud, ferocious, and vindictive. The common people, though celebrated for their bravery, fidelity, and attachment to their chiefs, are counted very savage, and much addicted to rapine. They speak the Erse language, and conform to the customs we have described as peculiar to the Highlanders. They pay very little attention to any sort of commerce but that which consists in the sale of their black cattle, and lead a sort of vagrant life among the hills; hunting, fowling, and fishing, as the seasons permit, and as their occasions require. They delight in arms, which they learn to handle from their infancy; submit patiently to discipline in the character of soldiers; and never fail to signalize themselves in the field by their sobriety, as well as their valour. While they remain in their own country, nothing can be more penurious, mean, sordid, and uncomfortable, than the way of life to which these poor people are inured, whether we consider their dress, diet, or lodging. In point of provision, they are so impoverished or ill supplied, that, before the winter is over, whole families are in danger of starving. In this emergency, they bleed their miserable cattle, already reduced to skin and bone, and eat the blood boiled with oatmeal. This evacuation, added to their former weakness, enfeebles the cows to such a degree, that when they lie down they cannot rise again without assistance.

LOCHIA, in midwifery, a flux from the uterus consequent to delivery. See MIDWIFERY.

LOCK, a well-known instrument used for fastening doors, chests, &c. generally opened by a key.

The lock is reckoned the master-piece in smithery; a great deal of art and delicacy being required in contriving and varying the wards, springs, bolts, &c. and adjusting them to the places where they are to be used, and to the various occasions of using them.

From the various structure of locks, accommodated to their different intentions, they acquire various names. Those placed on outer-doors are called *stock-locks*; those on chamber-doors, *spring-locks*; those on trunks, *trunk-locks*, *pair-locks*, &c.

Of these the spring-lock is the most considerable, both for its frequency and the curiosity of its structure. Its principal parts are, the main-plate, the cover-plate, and the pin-hole: to the main-plate belong the key-hole, top-hook, cross-wards, bolt-toe or bolt-knob, drawback-spring tumbler, pin of the tumbler, and the staples; to the cover-plate belong the pin, main-ward, cross-ward, step-ward or diap-ward; to the pin-hole belong the hook-ward, main cross-ward, shank, the pot or bread, bow-ward, and bit.

As on the proper construction of locks the security of the most valuable kinds of property almost entirely depends, and as numberless devices are continually fallen upon to elude the utmost efforts of mechanical invention in this respect, it thence becomes an object of no small importance to invent a lock which it should be impossible to open except by its proper key. A treatise upon this subject has been published by Mr Joseph Brama; who is confident that he has brought the matter to the requisite perfection, and that every one may rest assured of the security of his property when under the protection of a lock of his invention. He begins with observing, that the principle on which all locks depend, is the application of a lever to an interior bolt, by means of a communication from without; so that, by means of the latter, the lever acts upon the bolt, and moves it in such a manner as to secure the lid or door from being opened by any pull or push from without. The security of locks in general therefore depends on the number of impediments we can interpose betwixt the lever (the key) and the bolt which secures the door; and these impediments are well known by the name of *wards*, the number and intricacy of which alone are supposed to distinguish a good lock from a bad one. If these wards, however, do not in an effectual manner preclude the access of all other instruments besides the proper key, it is still possible for a mechanic of equal skill with the lock-maker to open it without the key, and thus to elude the labour of the other.

"Locks (says our author) have been constructed, and are at present most used and held in great esteem, from which the picklock is excluded: but the admission of false keys is an imperfection for which no locksmith has ever found a corrective; nor can this imperfection be remedied whilst the protection of the bolt is wholly confined to *fixed wards*." This position is proved by a remark, that the wards, let them be as intricate as we please, must all be expressed on what is called the *bit* or *web* of the key: and therefore, when all the varieties that can be expressed on this bit or web have been run through, every succeeding lock must be the counterpart of some other; and consequently the same.

same key which opens one will open the other also. This is evident from the locks usually put upon drawers; and which, though they should be made to refit the picklock, are still liable to be opened by ten thousand other keys besides that appropriated to each of them. But though the variety of wards could be augmented even to infinity, still there could be no security against false keys; for as every one of the wards must be expressed on the web of the key, if another key with a web quite plain be made to fit the key-hole exactly, we have only to cover it over with some colouring substance upon which the wards may make an impression; after which, it is easy to cut out the web in a proper manner for admitting them, when the lock will be as easily opened by the false as by the true key.

The first person, according to our author, who had any claim to merit in the branch of lock-making, is Mr Baron; whose lock he acknowledges to be by far more perfect and secure than any that ever appeared before; though he still considers it as unfit for giving that absolute security which is to be wished for. His improvement consisted in the proper application of what are called *grapples*. "These (says Mr Braham) are a kind of grapple; by which the bolt is confined, as well in its active as in its passive station, and rendered immoveable till set at liberty by the key. One of these instruments is commonly introduced into all locks that are of any use or value; it is lodged behind the bolt, and is governed by a spring which acts upon the tumbler as the tumbler acts upon the bolt: The application therefore of any force to the tumbler, which is superior to the force of the spring, will cause it to quit its hold, and set the bolt at liberty." In the common method of applying these machines, however, it matters nothing how far the tumbler is lifted above the point at which it ceases to control the bolt; but it is otherwise in those of Mr Baron's construction. The action of his tumblers is circumscribed by a certain space cut in the centre of the bolt, of dimensions sufficient only to answer the purpose intended. The space in which the tumbler moves is an oblong square; and is not only furnished with niches on the under side into which the hooks of the tumblers are forced by the spring as in other locks, but is provided with correspondent niches on the other side, into which the hooks are driven, if any greater force be applied to the tumblers than what is just sufficient to disengage them from the bolt. Hence it becomes absolutely necessary, in the making of a false key, to construct it in such a manner, that it may with the greatest exactness give the requisite degree of pressure, and no more.

Mr Braham allows that this is a very great improvement, but objects that it is still possible to frame a key which will open it as well as its own; nor will the addition of any number of tumblers preclude the possibility of opening it. "By giving (says he) an uniform motion to the tumblers, and presenting them with a face which exactly tallies with the key, they still partake, in a very great degree, of the nature of *fixed wards*; and the security of his lock is thereby rendered in a proportionable degree defective. Thus, suppose the false key to have passed the wards, and to be in contact with the most prominent of the tumblers, the impression, which the slightest touch will leave on the key, will direct the application of the file till

sufficient space is prepared to give it a free passage. The key will then bear upon a more remote tumbler; which difficulty being in like manner got over, the lock will be as easily opened by the false as by the true key."

This seemingly insuperable objection to the perfection of lock-making, however, our author removes with the greatest ease imaginable, by causing the tumblers which project unequally to present a *plane surface*: whence they would require a separate and unequal motion to disengage them; of consequence no distinct impression could be made by them upon the plane surface of the web that would give any idea of their positions with regard to one another, and the construction of a false key would be altogether impossible.

But though the principal difficulty with regard to Mr Baron's lock be now overcome, others still occur, *viz.* the difficulty of making locks which are constructed with tumblers sufficiently durable. The tumblers themselves, he observes, must be but slightly made; and being exposed to perpetual friction by the key and their own proper motion, they must soon decay; and the keys of Mr Baron's locks, he also observes, are much less durable than those of any other locks he ever saw.

With regard to the lock which Mr Braham presents to the public as absolutely perfect, he informs us, that the idea of constructing it was first suggested by the alarming increase of house-robberies, which may reasonably be supposed to be perpetrated in a great measure by perfidious servants, or accomplished by their connivance. Thus it is evident, that the locks which might exclude ordinary house-breakers could be no security against faithless servants, who having constant access to the locks, might easily get false keys fabricated at their leisure. In considering the subject, our author was convinced, that his hope of success depended entirely upon his using means as dissimilar as possible to those by which the old locks were constructed; as these, however varied, had been found insufficient for the purpose. "As nothing (says he) can be more opposite in principle to *fixed wards* than a lock which derives its properties from the *motion* of all its parts, I determined that the construction of such a lock should be the subject of my experiment." In the prosecution of this experiment he had the satisfaction to find, that the least perfect of all his models fully ascertained the truth and certainty of his principle. The exclusion of wards made it necessary to cut off all communication between the key and the bolt; as the same passage, which (in a lock *simply* constructed) would admit the key, might give admission likewise to other instruments. The office, therefore, which in other locks is performed by the extreme point of the key, is here assigned to a lever, which cannot approach the bolt till every part of the lock has undergone a change of position. The necessity of this change to the purposes of the lock, and the absolute impossibility of effecting it otherwise than with the proper key, are the points to be ascertained; and this our author does in the following manner.

Fig. 1. Shows Mr Braham's first attempt to construct a lock upon this principle: which, to his surprise, turned out complete and perfect. A represents a common axis on which the six levers, crossing the face

Lock.

Platē CCLXXII.

Fig. 8.

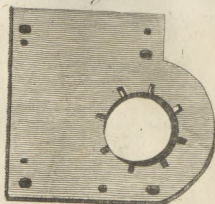


Fig. 10.

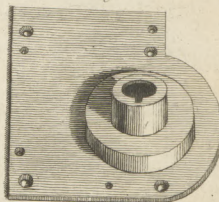


Fig. 1.

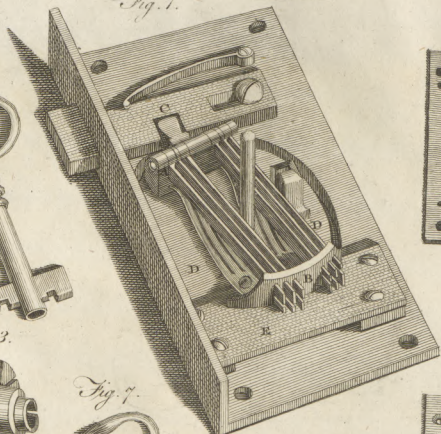


Fig. 2.

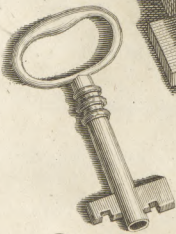


Fig. 3.

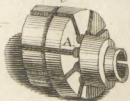


Fig. 7.



Fig. 6.

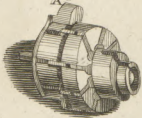


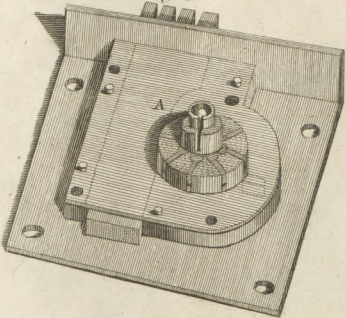
Fig. 4.



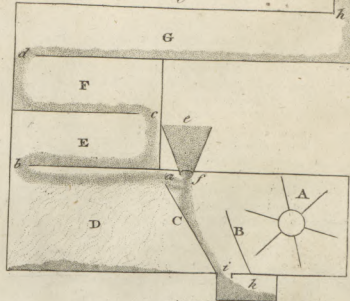
Fig. 5.



Fig. 9.



Levigating Sanner.



A. Bull Penn. Mat. Sculptor. fecit.

Lock.

Lock.

face of the lock, are united as on a joint. Each of these rests upon a separate spring sufficiently strong to bear its weight; or, if depressed by a superior force, to restore it to its proper position when that force is removed. B represents a frame through which the levers pass by separate grooves, exactly fitted to their width, but of sufficient depth to allow them a free motion in a perpendicular direction. The part which projects from the opposite side of the joint A, and is inserted in the bolt C, is a lever to which two offices are assigned; one to keep the bolt in a fixed position, in the absence of the key; the other, to give it its proper motion upon the application of the key. D is a circular platform turning upon a centre. On this the joint or carriage of the levers, and the springs on which they rest, are fixed; and the motion of this platform impels the bolt, in either direction, by means of the lever which is projected from the joint A. The inviolable restraint upon this lock, by which means it is subjected only to the action of the key, is lodged in the part E, which is a thin plate, bearing at each extremity on a block, and having of course a vacant space beneath, equal in height to the thickness of the blocks on which it rests. By this plate the motion of the machine is checked or guided in the following manner: On the edge of the plate which faces the movement there are six notches, which receive the ends of the levers projecting beyond the frame B; and while they are confined in this manner, the motion of the machine is so totally suspended as to defy every power of art to overcome.

To understand in what manner the proper key of this lock overcomes these obstacles, it must be observed, that each lever has a notch on its extremity, and that those notches are disposed as irregularly as possible. To give the machine a capacity of motion, these notches must be brought parallel to each other, and by a distinct but unequal pressure upon the levers, be formed into a groove in a direct line with the edge of the plate E, which the notches are exactly fitted to receive. The least motion of the machine, while the levers are in this position, will introduce the edge of the plate into the groove; which, controuling the power of the springs, will give liberty to the levers to move in an horizontal direction as far as the space between the blocks which support the plate E will admit, and which is sufficient to give the machine a power of acting on the bolt. The impossibility of thus bringing the notches on the points of the levers into a direct line, so as to tally with the edge of the plate E by any other means than the motion and impulse of the key, is that which constitutes the principal excellency of this lock.

The key (fig. 2.) exhibits six different surfaces, against which the levers are progressively admitted in the operation of opening the lock: the irregularity of these surfaces shows the unequal and distinct degree of pressure which each lever requires to bring them to their proper bearings, in order to put the machine in motion. Hence it appears, that unless the various heights of the surfaces expressed on the bit of the key are exactly proportioned to the several distances necessary to bring the notches into a straight line with each other, they must remain immovable; "and (says our author) as one stroke of a file is sufficient to cause

such a disproportion as will prove an unfurmountable impediment to their motion, I may safely assert, that it is not in art to produce a key or other instrument, by which a lock, constructed upon this principle, can be opened."

On this principle it would even be a matter of great difficulty for any workman, however skilful, to construct a key for the lock when open to his inspection: "for the levers being raised, by the subjacent springs, to an equal height in the frame B, present a plane surface; and consequently convey no direction that can be of any use in forming a tally to the irregular surface which they present when acting in subjection to the key. Unless therefore we can contrive a method to bring the notches on the points of the levers in a direct line with each other, and to retain them in that position till an exact impression of the irregular surface, which the levers will then exhibit, can be taken; the workman will be unable to fit a key to the lock, or to move the bolt. This process must be rendered extremely troublesome by means of the springs; and if such difficulties occur, even when the lock is open to the inspection of a skilful workman, much more must we suppose it out of the power of one who has not access to the internal parts to make a false key to a lock of this kind.

These difficulties render it necessary in making locks of this kind not to fit the key to the lock, as is usual in other locks, but to fit the lock to the key. In this kind of lock, therefore, the key must be made first; and the inequalities upon the surface of the bit worked as chance or fancy may direct, without any reference to the lock. The key being thus completed, and applied to the surface of the levers, will, by a gentle pressure, force them to unequal distances from their common station in the frame B, and sink their points to unequal depths into the space beneath the plate E. While the levers are in this position, the edge of the plate E will mark the precise point at which the notch on each lever must be expressed. The notches being cut by this direction, the irregularity which appears when the levers resume their station in the frame B, and the inequality of the recesses on the bit of the key, will appear as a seal and its corresponding impression.

The following is a lock contrived upon the same principle, but more curious; and, in our author's opinion, more extensively useful. Fig. 3. represents a circular block of metal divided from the centre into eight compartments, each containing a cell which forms a passage through the block, as is represented by the small circles described on the flat surface A. In each of these cells two grooves are cut at opposite points, which open a communication with the centre at one point, and with the spherical surface of the block or barrel at the other. The small circle, which marks the centre of the flat surface A, is the key-hole, which likewise forms a passage through the barrel in a parallel line with the cells which surround it. This figure represents the frame in which the active parts of the lock are deposited.

Fig. 4. shows a spiral spring lodged in the bottom of each cell, and occupying one half of the space, the other being filled with a slider resting upon the spring, and represented by fig. 5. the office of these sliders ex-

P actively

Look.

ally corresponding with that of the levers in the lock already described. Thus, when lodged in their respective cells, they are sustained, like the levers, by the elasticity of the springs upon which they rest, till a superior power be applied; and they are again restored to their stations by the reaction of the springs when the weight is removed. The side B of each slider is projected beyond the circular surface, as represented fig. 6. in a manner similar to the projection of the levers in the former lock beyond the curved frame in which they move. The point C is projected through the interior groove into the space which forms the centre or key-hole, expressed on the flat surface A.

Fig. 7. represents the key. When this is applied, it must of course encounter these interior projections; and when pressed forward, the indented spaces on its point being unequal, will force the sliders to unequal distances from their bearers; bringing the notches expressed on their exterior projections in a direct line with each other, in a manner similar to that by which the effect is produced upon the levers in the former lock. When the key is withdrawn, and the sliders resume their stations by the pressure of the springs, the disposition of the notches must be irregular in the same proportion that the indentations on the point of the key are unequal; and they must necessarily fall again into a straight line when acted upon by the key.

Fig. 6. shows the barrel completely fitted for action. Its interior end is capped with a plate, which unites its compartments, and confines the springs and sliders within the cells to which they belong. From that plate proceeds the point A, which represents the lever by which the bolt is projected or withdrawn, according to the direction in which the machine performs its revolution.

Fig. 8. shows the flat surface of a thin plate, corresponding in its office with the part C of the former lock. The space cut in its centre is exactly fitted to the spherical surface of the barrel; the circle describing its circumference, and the notches cut on its edge, coinciding with the projections of the sliders. The barrel, when encircled with this plate at the middle of its spherical surface, has its motion totally suspended till the notches on the projections of the sliders are forced, by the pressure of the key, into a line with each other: a groove being thus formed on the spherical surface of the barrel parallel to, and coinciding with, the edge of the plate, the machine is at liberty to perform a revolution in any direction, but returns to its confined state when the key is withdrawn.

The parts of the movement being thus united, the interior end of the barrel is deposited in a bed represented fig. 9. To this it is fastened at the angles of the plate represented fig. 8. by which the barrel is encircled. The station of the bolt is at A; the lever which acts upon it being projected on the other side. Fig. 10. is a cap or maul which covers the face of the movement, and completes the lock.

On this lock our author observes, that it is excellent for street-doors: "for no method of robbery (says he) is more practised, than gaining admittance into houses by those keys, which, as is well known, may be procured at the old iron shops to fit almost any lock in use. Such robberies are generally committed where the servants are allowed to take the key with them

when sent on errands, it being impracticable while the key is fixed in the lock. The variations, by which the production of correspondent keys is avoided, have two sources: the one arising from the changes that may be made in the disposition of the levers; the other, from the number of points contained on the projected surface of each lever; by which the position of its notch may, in the smallest degree, be varied.

"The variations, producible in the dispositions of six figures only, are 720: these, being progressively multiplied by additional figures, will increase by astonishing degrees; and eventually show, that a lock containing twelve levers will admit of 479,001,500 changes; which, with the addition of another lever, will increase to 6,229,019,500. These being again multiplied by the number of changes which the projected surface of the levers will admit in the disposition of the notches, their amount will exceed numeration, and may therefore be properly said to be infinite. The slightest inspection will at once show, that their construction precludes all possibility of obtaining an impression of their internal parts, which is necessary for the fabrication of a false key; for it will be easily seen, that the positions into which the levers are forced by the pressure of the key in opening the lock, can no more be ascertained when the key is withdrawn, than the seal can be copied from its impression on a fluid, or the course of a ship be discovered by tracing it on the surface of the waves. But inviolable security is not the only excellence they possess: the simplicity of their principle gives them likewise a great advantage over locks that are more complicated, in point of duration; for their essential parts being subject to no friction, nor exposed to any possible accident from without, they will be less affected by use, and less liable to stand in need of repair."

Lock, or *weir*, in inland navigations, the general name for all those works of wood or stone made to confine and raise the water of a river: the banks also which are made to divert the course of a river, are called by these names in some places. But the term *lock* is more particularly appropriated to express a kind of canal inclosed between two gates; the upper called by workmen the sluice-gate, and the lower called the flood-gate. These serve in artificial navigations to confine the water, and render the passage of boats easy in passing up and down the stream. See CANAL.

LOCKE (John), a most eminent English philosopher and writer in the latter end of the 17th century, was son of Mr John Locke of Pensford in Somersetshire, and born at Wrington near Bristol in 1632. He was sent to Christ-church in Oxford; but was highly dissatisfied with the common course of studies then pursued in the university, where nothing was taught but the Aristotelian philosophy; and had a great aversion to the disputes of the schools then in use. The first books which gave him a relish for philosophy, were the writings of Des Cartes: for though he did not always approve of his notions, yet he thought he wrote with great perspicuity. He applied himself with vigour to his studies, particularly to physics, in which he gained a considerable knowledge, though he never practised it. In 1694, he went to Germany as secretary to Sir William Swan, envoy from the English court to the elector of Brandenburg and some other

Lock.

Locke.

other German princes. In less than a year, he returned to England; where, among other studies, he applied himself to that of natural philosophy, as appears from a register of the changes of the air, which he kept at Oxford from June 24. 1666, to March 28. 1667. There he became acquainted with the lord Ashly, afterwards earl of Shaftesbury, who introduced him into the conversation of some of the most eminent persons of that time. In 1670, he began to form the plan of his *Essay on Human Understanding*; but his employments and avocations prevented him from finishing it then. About this time he became a member of the Royal Society. In 1672, his patron, now earl of Shaftesbury, and lord chancellor of England, appointed him secretary of the presentations, which place he held till the earl resigned the great seal. In 1673, he was made secretary to a commission of trade, worth 500*l.* a-year; but that commission was dissolved in 1674. The earl of Shaftesbury being restored to favour, and made president of the council in 1679, sent for Mr Locke to London: but that nobleman did not continue long in his post, being sent prisoner to the tower; and after his discharge retired to Holland in 1682.

Mr Locke followed his patron thither. He had not been absent from England a year, when he was accused at court of having written certain tracts against the government, which were afterward discovered to be written by another person; and in November 1684, he was deprived of his place of student in Christ-church. In 1685, the English envoy at the Hague demanded him and 83 other persons to be delivered up by the States General: upon which he lay concealed till the year following; and during this time formed a weekly assembly with Mr Limborch, Mr Le Clerc, and other learned men at Amsterdam. In 1689 he returned to England in the fleet which conveyed the prince of Orange; and endeavoured to procure his restoration to his place of student of Christ-church, that it might appear from thence that he had been unjustly deprived of it: but when he found the college would admit him only as a supernumerary student, he desisted from his claim.

Being esteemed a sufferer for revolution-principles, he might easily have obtained a more profitable post; but he contented himself with that of commissioner of appeals, worth 200*l.* a year, which was procured for him by the Lord Mordaunt, afterwards earl of Monmouth, and next of Peterborough. About the same time he was offered to go abroad in a public character; and it was left to his choice, whether he would be envoy at the court of the emperor, that of the elector of Brandenburg, or any other where he thought the air most suitable to him: but he waved all these, on account of the infirm state of his health; which disposed him gladly to accept another offer that was made by Sir Francis Mafham and his lady, of an apartment in their country-seat at Oates in Essex, about 25 miles from London.

This place proved so agreeable to him in every respect, that it is no wonder he spent the greatest part of the remainder of his life at it. The air restored him almost to a miracle, in a few hours after his return at any time from the town, quite spent and unable to support himself. Besides this happiness here, he

found in lady Mafham a friend and companion exactly to his heart's wish; a lady of a contemplative and studious complexion, and particularly inured, from her infancy, to deep and refined speculations in theology, metaphysics, and morality. In this family Mr Locke lived with as much ease as if the whole house had been his own; and he had the additional satisfaction of seeing this lady breed up her only son exactly upon the plan which he had laid down for the best method of education; the success of which was such as seemed to give a sanction to his judgment in the choice of that method. In effect, it is to the advantage of this situation that he derived so much strength as to continue exerting those talents which the earl of Shaftesbury had observed to be in him for political subjects. Hence we find him writing in defence of the revolution in one piece; and considering the great national concern at that time, the ill state of the silver coin, and proposing remedies for it, in others. Hence he was made a commissioner of trade and plantations in 1695, which engaged him in the immediate business of the state; and with regard to the church, he published a treatise the same year, to promote the scheme which king William had much at heart, of a comprehension with the dissenters. This, however, drew him into one controversy; which was scarcely ended, when he entered into another in defence of his essay, which held till 1698: soon after which the asthma, his constitutional disorder, increasing with his years, began to subdue him; and he became so infirm, that in 1700 he resigned his seat at the board of trade, because he could no longer bear the air of London sufficient for a regular attendance upon it. After this resignation he continued altogether at Oates; in which retirement he employed the remaining last years of his life entirely in the study of the holy Scriptures.

He died in 1704, aged 73. His writings will immortalize his name. The earl of Shaftesbury, author of the *Characteristicks*, though in one place he speaks of Mr Locke's philosophy with severity; yet observes, concerning his *Essay on the Human Understanding*, in general, "that it may qualify men as well for business and the world, as for the sciences and the universality." Whoever is acquainted with the barbarous state of the philosophy of the human mind, when Mr Locke undertook to pave the way to a clear notion of knowledge, and the proper methods of pursuing and advancing it, will be surprized at this great man's abilities; and plainly discover how much we are beholden to him for any considerable improvements that have been made since. His *Discourses on Government*, *Letters on Toleration*, and his *Commentaries on some of St Paul's Epistles*, are justly held in the highest esteem.

LOCKED JAW. See (the *Index* subjoined to) **MEDICINE.**

LOCKMAN, an officer in the Isle of Man, who executes the orders of government, much like our undersheriff.

LOCKMAN, an eastern philosopher. See **LOCKMAN.**

LOCLE, a small town in a district of the same name in Switzerland, adjacent to Neuchâtel and Valengin, and united with another named *La Glause de Fond*. Both these districts occupy some valleys formed by the mountains of Jura; the greatest part of

Locle,
Locri.

which not many years ago was one continued forest, though now converted into fine pasture-ground fitted with flourishing villages. The increase of population in these districts is particularly evident from the following circumstance, *viz.* that formerly the produce of the country was more than sufficient to serve the inhabitants; but now, though considerably better cultivated, it scarce furnishes an eighth part of the necessary consumption. This great increase of numbers is owing to the early marriages of the inhabitants; to the liberty allowed to every stranger, who brings a certificate of his good behaviour, to settle in the district; to follow any trade without restriction, and without an apprenticeship; and to the want of taxes, and an unbounded freedom of commerce. The industry and genius of the people in these districts is very surprising. They carry on an extensive commerce in lace, stockings, cutlery, and other merchandise of their own manufacture; and particularly excel in every branch of watch and clock making. They make all the utensils necessary in these arts, and have invented several new ones. There are also in these districts painters, gilders, enamellers, engravers, and other artists necessary for completing the business of watch making; by which means that business is carried on to so great an extent, that 40,000 watches are computed to be annually made. Besides these arts already mentioned, the people are extremely ingenious in other branches of mechanics, and have invented several astronomical and mathematical instruments. One of the most eminent in this way is Jaquet Droz, now at Paris; and whose son exhibited several surprising automatical figures in England. One of these played upon a harpichord; another drew landscapes; and a third copied any word presented to it, or wrote down whatever was dictated by any of the company.

The inhabitants of these districts are very courteous to strangers who visit them: they are in general well informed in several branches of knowledge; and as they commonly employ their leisure hours in reading, they have circulating libraries in many of their villages. Their houses are plastered, white washed, well built, and commodious, though small; being besides furnished with a degree of neatness and even elegance peculiarly striking in these sequestered mountains. "Such perfect ease and plenty (says Mr Coxe) reigns throughout these mountains, that I scarcely saw one object of poverty: the natural effects of industry under a mild and equitable government."

LOCRI, or *Locri Epizephyrii*, (anc. geog.), a town of the Brutii, on the Ionian sea: a colony of the Locri Ozolæ (Strabo); rather of the Epicnemidii (Virgil), who calls it *Naryeti Locri*, from Naryx a town of the Locri Epicnemidii. The epithet *Epizephyrii* is from its situation near the promontory Zephyrium (Strabo); *Locri* and *Locrenses*, the people. They are said to be the first who used a code or body of written laws, compiled by Zalcucus from the laws of the Cretans, Lacedæmonians, and the Areopagitæ, adding an express penalty to each law, which was before discretionary, at the option of the judge (Strabo). Adultery was punished with the loss of both eyes. His own son being convicted of this crime; to maintain at the same time the authority of the law, and to pay some regard to the intercession of the people in favour of his son,

Zalcucus suffered the loss of an eye, his son losing another (Ælian, Val. Maximus.)

LOCRIIS, the district or territory of Locri in the Brutii in Italy.

LOCRIIS, a country of Achaia in Greece; twofold, and divided by mount Parnassus. The Hither was occupied by the Locri Ozolæ, called also *Zephyrii*, or Western, contained between Ætolia and Phocis, beginning at Naupactum, and running in a narrow slip of land, scarce 200 stadia, along the sea to the borders of the Phœociens. The Farther Locriis lay beyond Parnassus, running out towards Thermopylæ, and reaching to the Euripus of Eubœa; occupied by the Locri Opuntii, who dwelt on the Eubœan sea; and the Epicnemidii, who occupied mount Cnemis (Strabo); and these two were the Eastern Locri.

LOCUS GEOMETRICUS, denotes a line by which a local or indeterminate problem is solved.

A *locus* is a line, any point of which may equally solve an indeterminate problem. Thus if a right line suffice for the construction of the equation, it is called *locus ad rectum*; if a circle, *locus ad circulum*; if a parabola, *locus ad parabolam*; if an ellipsis, *locus ad ellipsin*: and so of the rest of the conic sections.

LOCULAMENTA, and LOCULI, in botany; cells or pockets: The internal divisions of a capsule, or other dry seed-vessel, so termed.—These cells contain or inclose the seeds; and are different in number in different plants.

The term LOCULUS is also sometimes used to express the minute divisions in some species of *antheræ*, which contain the fine impalpable powder supposed by the sexualists to be the principal agent in the generation of plants.

LOCUST, in zoology. See GRYLLUS.

LOCUST-Eaters. See ACRIDOPHAGI.

American LOCUST, or Frog-hopper. See CICADA.

LOCUST-Tree. See HYMENÆA and GLEDITSIA.

LOCUTIUS, in mythology, the god of speech among the Romans, called by Livy *Avus Locutius*.

LOCUTORIUM. The monks and other religious in monasteries, after they had dined in their common hall, had a withdrawing-room, where they met and talked together among themselves, which room, for that sociable use and conversation, they called *locutorium*, a *loquendo*; as we call such a place in our houses parlour, from the French *parler*; and they had another room, which was called *locutorium forinsecum*, where they might talk with laymen.

LODGMET, in military affairs, a work made by the besiegers in some part of a fortification (after the besieged have been driven out), to maintain it, and be covered from the enemy's fire.—When a lodgement is to be made on the glacis, covert-way, or in a breach, there must be a great provision made of fascines, sand-bags, gabions, wool-packs, &c. in the trenches; and during the action, the pioneers, under the direction of an engineer, with fascines, sand-bags, &c. should be making the lodgment, in order to form a covering, while the grenadiers are storming the covert-way.

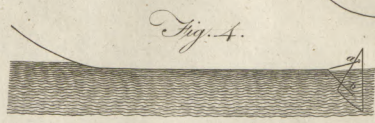
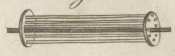
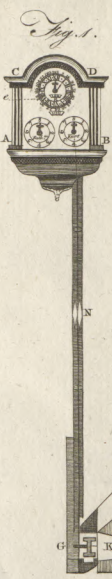
LODE, in mining. See LOAD.

LOG, in the Jewish antiquities, a measure which held a quarter of a cab, and consequently five-sixths of a pint. There is mention of a log, 2 Kings vi. 25.

Locris,
Log.

Log.
Fig. 2.

Fig. 3.



Logarithms.

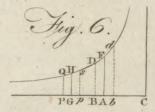
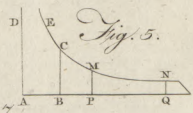
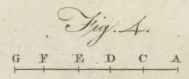
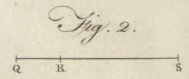
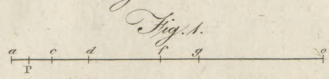


Fig. 7.

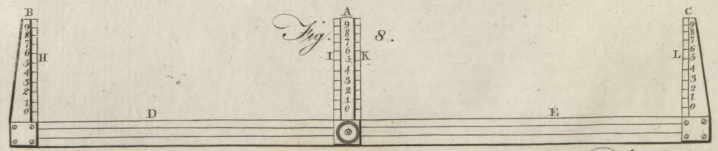
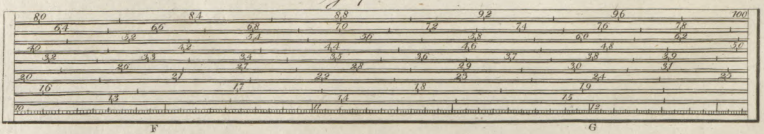


Fig. 9.

Fig. 10.

Fig. 11.

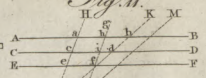


Fig. 12.

Log.

under the name of a *fourth part of a cab*. But in Leviticus the word *log* is often met with, and signifies that measure of oil which lepers were to offer at the temple after they were cured of their disease. Dr Arbuthnot says, that the *log* was a measure of liquids, the seventy-second part of the bath or ephah, and twelfth part of the hin, according to all the accounts of the Jewish writers.

Plate
CCLXXII
fig. 3.

Log, a sea term, signifying a small piece of timber *a*, of a triangular, fectoral, or quadrantal figure, on board a ship, generally about a quarter of an inch thick, and five or six inches from the angular point to the circumference. It is balanced by a thin plate of lead, nailed upon the arch, or circular side, so as to swim perpendicularly in the water, with about two thirds immersed under the surface.

Log-Line, a little cord, or line, about a hundred and fifty fathoms long, fastened to the log by means of two legs *ab* (fig. 4.), one of which passes through a hole at the corner, and is knotted on the opposite side, while the other leg is attached to the web by a pin fixed into another hole, so as to draw out occasionally. By these legs the log is hung in equilibrio; and the line thus annexed to it is wound round a reel fixed for that purpose in the gallery of the ship.

This line, from the distance of about ten, twelve, or fifteen fathoms off the log, has certain knots or divisions, which ought to be at least fifty feet from each other; though it was the common practice at sea not to have them above forty-two feet asunder.

The length of each knot ought to be the same part of a sea-mile as half a minute is of an hour; and admitting the measurement of Mr Norwood, who makes a degree on a great circle of the earth to contain 367,200 English feet, or about 60½ English statute miles, and, therefore, $\frac{1}{60}$ th part of it, or a nautical mile, will be 6120 feet; $\frac{1}{12}$ th of 6120, or 51 feet, should be the length of each knot. But because it is safer to have the reckoning rather before the ship than after it, therefore fifty feet may be taken as the proper length of each knot. The knots are sometimes made to consist only of forty-two feet each, even in the present practice; and this method of dividing the log-line was founded on the supposition that sixty miles, each of 5000 English feet, made a degree; for $\frac{1}{60}$ of 5000 is 83⅓, or, in round numbers, 82 feet. Mariners, rather than quit the old way, though known to be erroneous, use glasses for half minute ones, that run but 24 or 25 seconds. They have also used a line of 45 feet to 30 seconds, or a glass of 28 seconds to 42 feet. When this is the case, the distance between the knots should be corrected by the following proportion: as 30 is to 50; so is the number of seconds of the glass to the distance between the knots upon the line. The heat or moisture of the weather has often a considerable effect upon the glass, so as to make it run slower or faster; it should, therefore, be frequently tried by the pendulum in the following manner. On a round nail hang a string that has a musket-ball fixed to one end, carefully measuring between the centre of the ball and the string's loop over the peg 39½ inches, being the length of a second pendulum; then swing it, and count one for every time it passes under the peg, beginning at the second time it passes; and the number of swings made during the time

the glass is running out shows the seconds it contains. The line also is liable to relax and shrink, and should therefore be occasionally measured.

The use of the log and line is to keep account and make an estimate of the ship's way or distance run; which is done by observing the length of line unwound in half a minute's time, told by a half-minute glass; for so many knots as run out in that time, so many miles the ship sails in an hour. Thus, if there be four knots veered out in half a minute, the ship is computed to run four miles an hour.

The author of this device for measuring the ship's way is not known; and no mention of it occurs till the year 1607, in an East-India voyage published by Purchas; but from that time its name occurs in other voyages among his collections; and henceforward it became famous, being taken notice of both by our own authors and by foreigners; as by Gunter in 1623; Snellius in 1624; Metius in 1631; Oughtred in 1633; Herigone in 1634; Saltonstall in 1636; Norwood in 1637; Pournier in 1643; and almost by all the succeeding writers on navigation of every country.

To *Heave the Log*, as they call it, they throw it into the water on the lee-side, letting it run till it comes without the eddy of the ship's wake; then one, holding a half-minute glass, turns it up just as the first knot, or the mark from which the knots begin to be reckoned, turns off the reel (fig. 2.) or passes over the stern. As soon as the glass is out, the reel is stopped, and the knots run off are told, and their parts estimated.

It is usual to heave the log once every hour in ships of war and East-India men, and in all other vessels once in two hours; and if at any time of the watch the wind has increased or abated in the intervals, so as to affect the ship's velocity, the officer generally makes a suitable allowance for it at the close of the watch.

The log is a very precarious way of computing, and must always be corrected by experience and good sense; there being a great deal of uncertainty in the yawing of the ship going with the wind aft, or upon the quarter in the heaving of it, by its coming home, or being drawn after the ship, on account of the friction of the reel and lightness of the log in the course of the current, and in the strength of the wind, which seldom keeps the same tenor for two hours together; which is the interval between the times of using the log in short voyages, though in longer ones they heave it every hour. Yet this is a much more exact way of computing than any other in use; much preferable certainly to that of the Spaniards and Portuguese, who guessed at the ship's way by the running of the froth or water by the ship's side; or to that of the Dutch, who used to heave a chip over-board, and to number the paces they walk on the deck while the chip swims between any two marks, or bulk-heads on the side.

Compound Log. The above mentioned errors, and particularly the log's being subject to drive with the motion which the water may have at its surface, whereas the experiment requires it to be fixed in the place where it is when the mark commencing the knots goes off the reel, have been considered by writers, and many methods have been proposed to remove, or at least to lessen them.

Log.

Log. The late M. Bouguer proposed a method, which has been thought deserving of particular attention, in the Mem. Acad. Sc. 1747; afterwards in his *Treatise on Navigation*, published at Paris in 1753, and since reprinted in 1760, by the abbé de la Caille. For this purpose, take for the log a conical piece of wood, which fix to the log-line passed through or along its axis, at about 40, 50, or 60, or more feet, from one end; and to this end fix the diver, which is a body formed of two equal square pieces of tin, or of thin iron plate, fixed at right angles to one another along their diagonals; and its size is fitted to that of the cone, that the whole may float. A cone of three inches diameter in the base, and of six inches in the slant height, is proposed by M. Bouguer to suit a diver made of plates about 9½ inches square; the intersection of the diagonals is joined to the log-line, and the loop and peg fixed as in the common log. However, it has been found, that no kind of wood used in British dock-yards, when formed into a cone of the above dimensions, will float a diver made of stout tin plates, one side of the square being 9½ inches. Such a diver weighing 1½ lb avoirdupois, required to float it a cone of five inches diameter and twelve inches on the slant side, so as the point of the cone, which was made of light fir, should just appear above the water. Now supposing one side of such a square tin-diver to be about ten inches, and made of plates only two-thirds of the thickness of the former, such a diver would weigh, with its folder, about 20 ounces, and can be floated by a light fir cone of four inches diameter in the base, and ten inches in the slant height or length; and such a compound log might perhaps be found on trial to be affected by about as much again as that proposed by M. Bouguer; and consequently the difference between the numbers given by the common log and compound log, must be augmented by two-thirds of itself for the necessary correction, as below. When the compound log of Bouguer, above described, is hove overboard, the diver will sink too deep to be much affected by the current or motion of water at the surface, and the log will thereby keep more steadily in the place where it first fell; and consequently the knots run off the reel will show more accurately the ship's rate of sailing. As the common log is affected by the whole motion of the current, so this compound log will feel only a part thereof, viz. such a part nearly as the resistance of the cone is to the resistance of the diver; then the resistances of the above cone and diver are about as 1 to 5; and consequently this log will drive but one-fifth part of what the common log would do; and so the ship's true run will be affected by one-fifth only of the motion of the waters. To obtain the true rate of sailing, it will be proper to heave alternately, hour and hour, the common log and this compound log; then the difference of their knots run off, augmented by its one-fourth part, is the correction; which applied to the knots of the common log, will give the ship's true rate of sailing at the middle time between the hours when these logs were hove. The correction is additive when the compound log's run is the greater, otherwise it is subtractive. To find the course made good: increase the observed angle between the log-lines by one-fourth part; and this gives the correction to be applied to the apparent course, or the opposite of that shown by

the common log; the correction is to be applied to the $\left\{ \begin{array}{l} \text{right} \\ \text{left} \end{array} \right\}$ of the apparent course, when the bearing of the common log is to the $\left\{ \begin{array}{l} \text{left} \\ \text{right} \end{array} \right\}$ of the compound log. Or thus: the lengths run off both logs, together with their bearings, being known; in a card or compass apply the knots run off, taken from a scale of equal parts along their respective bearings, from the centre; join the ends; and in this line produced, on the side next the compound log's length, take one-fourth of the interval; then a line drawn from the end, thus produced, to the centre of the card, will show the true course and distance made good. When a current, such as a tide, runs to any depth, the velocity of that current may be much better ascertained by the compound log than by the common one, provided the diver does not descend lower than the run of the current; for as those ships which are deeply immersed, drive faster with the tide; so the diver, by being acted on below, as well as the log on the surface, their joint motion will give the total effect of the current's motion better than what could be derived from the motion at the surface only. Also, by such a compound log, the depth to which any current runs may be easily tried.

Other Logs. We have an account in the voyage to the North Pole, p. 97, of two other logs, which were tried by captain Phipps: one invented by Mr Ruffel, the other by Foxon; both constructed upon this principle, that a spiral, in proceeding its own length in the direction of its axis through a resisting medium, makes one revolution round the axis; if, therefore, the revolutions of the spiral are registered, the number of times it has gone its own length through the water will be known. In both these the motion of the spiral in the water is communicated to the clock-work within-board, by means of a small line fastened at one end to the spiral, which tows it after the ship, and at the other to a spindle, which sets the clock-work in motion. That invented by Mr Ruffel has a half-spiral of two threads, made of copper, and a small dial with clock-work, to register the number of turns of the spiral. The other log has a whole spiral of wood with one thread, and a larger piece of clock-work with three dials, two of them to mark the distance, and the other divided into knots and fathoms, to show the rate by the half-minute glass, for the convenience of comparing it with the log. This kind of log will have the advantage of every other in smooth water and moderate weather; and it will be useful in finding the trim of a ship when alone, in surveying a coast in a single ship, or in measuring distances in a boat between head-lands and shoals; but it is subject to other inconveniences, which will not render it a proper substitute for the common log.

Perpetual Log. a machine so called by its inventor, Mr Gottlieb of Houndditch, London. It is intended by it to keep a constant and regular account of the rate of the ship's velocity through the water; whereas the common log hitherto used does not indicate the variation in her velocity in the interval of heaving the log, and consequently does not ascertain the true distance that the ship has run in any given length of time.

Log.

Log.

Plate
CLXXXIII

Fig. 1. is a representation of the whole machine; the lower part of which, EFG, is fixed to the side of the keel; H representing only the boundary line of the ship's figure. EF are the section of a wooden external case, left open at the ends KL, to admit the passage of the water during the motion of the ship. At M is a copper grating, placed to obstruct the entrance of any dirt, &c. into the machine. I, is a section of a water-wheel, made from 6 to 12 inches in diameter, as may be necessary, with float-boards upon its circumference, like a common water-wheel, that turn by the resistance of the water passing through the channel LK. It turns upon a shouldered axis, represented by the vertical section at K. When the ship is in motion, the resistance of the water through the channel LK turns round the wheel I. This wheel, by means of a pinion, is connected with and turns the rod contained in the long copper tube N. This rod, by a pinion fixed at its upper extremity, is connected with and turns upon the whole system of wheels contained in the dial of the case ABCD. This dial, by means of the copper tube N, may be fixed to any convenient place aboard the ship. In the front of the dial are several useful circular graduations, as follow: The reference by the dotted line A has an hand which is moved by the wheels within, which points out the motion of the ship in fathoms of 6 feet each. The circle at B has an hand showing the knots, at the rate of 48 feet for each knot; and is to be observed with the half-minute glass at any time. The circle at C has a short and a long hand; the former of which points out the miles in land measure, and the latter or longer the number of knots contained in each mile, viz. 128, which is in the same proportion to a mile as 60 minutes to the hour in the reckoning. At e, a small portion of a circle is seen through the front-plate called the *register*; which shows, in the course of 24 hours (if the ship is upon one tack), the distance in miles that she has run; and in the 24 hours the mariner need take but one observation, as this register serves as an useful check upon the fathoms, knots, and miles, shown upon the two other circles.

f, Is a plate showing 100 degrees or 6000 miles, and also acts as another register or check; and is useful

in case of any mistake being made in observing the distance run by the other circles. The reckoning by these circles, without fear of mistake, may therefore be continued to nearly 12,000 miles.

A communication from this machine may easily be made to the captain's bed-side, where by touching a spring only, a bell in the head ABCD will sound as many times in an half minute as the ship sails miles in an hour.

Mr Gottlieb has applied this machine to the Carteret and Westmoreland packets. He is very sanguine in the hopes of its success and utility; and conceives that the mariner will, by this contrivance, be better enabled than heretofore to keep the vessel and his reckoning together; it being well known that the most experienced navigator is too frequently erroneous in this respect, the ship being sometimes ahead, or sometimes astern, off the reckoning.

He also observes, that the construction of the log is such, that if the vessel was to be aground, strike a rock, or strip off her false keel, the parts would not be deranged: and further, should she be laid up for repairs, &c. six months, in half an hour after coming again into the water, the lower immersed part of the log would clear itself, and be in proper action.

Log-Board, a sort of table, divided into several columns, containing the hours of the day and night, the direction of the winds, the course of the ship, and all the material occurrences that happen during the 24 hours, or from noon to noon; together with the latitude by observation. From this table the different officers of the ship are furnished with materials to compile their journals, wherein they likewise insert whatever may have been omitted, or reject what may appear superfluous in the log-board.

Log-Book, a book into which the contents of the log-board is daily copied at noon, together with every circumstance deserving notice that may happen to the ship, or within her cognizance, either at sea or in a harbour, &c. The intermediate divisions or watches of the log-book, containing four hours each, are usually signed by the commanding officer in ships of war or East-Indiamen. See NAVIGATION.

L O G A R I T H M S.

LOGARITHMS, (from *λογος* ratio, and *αριθμος* number), the indices of the ratios of numbers to one another; being a series of numbers in arithmetical progression, corresponding to others in geometrical progression; by means of which, arithmetical calculations can be made with much more ease and expedition than otherwise.

SECT. I. History of Logarithms.

THE invention of logarithms first occurred to those versant in the construction of trigonometrical tables, in which immense labour was required by large multiplications, divisions, and extraction of roots. The aim proposed was, to reduce as much as possible the mul-

tiplications and divisions to additions and subtractions; and for this purpose, a method was invented by Nicholas Raymer Ursus Dithmarfus, which serves for one case of the sines, viz. when the radius is the first term in proportion, and the sines of two arcs the second and third terms. In this case the fourth term is found by only taking half the sum or difference of the sines of the other two arcs, and the complement of the greater. This method was first published in 1588, and a few years afterward was greatly improved by Clavius, who used it in all proportions in the solution of spherical triangles; adapting it to sines, tangents, versed sines, and secants; and this, whether the radius was the first term in the proportion or not.

This method, however, though now become much more

more generally useful than before, was still found attended with trouble in some cases; and as it depended upon certain properties of lines belonging to the circle, was rather of a geometrical than arithmetical nature; on which account the calculators about the end of the 16th and beginning of the 17th century, finding the solution of astronomical problems extremely troublesome, by reason of the tedious multiplications and divisions they required, continued their endeavours to lessen that labour, by searching for a method of reducing their operations to addition and subtraction. The first step towards this was, the consideration, that as in multiplication the ratio of the multiplier to unity is the same as that of the product to the multiplicand, it will follow, that the ratio of the product to unity must be equal to the sum of the two ratios of the multiplier to unity, and of the multiplicand to unity. Could a set of numbers therefore be found, which would represent the ratios of all other numbers to unity, the addition of two of the former set of numbers would be equivalent to the multiplication of the two numbers together, the ratios of which they denoted; and the sum arising from this addition would denote the ratio of their product to unity; whence the product itself might be found by looking for the corresponding natural number in the table.

The next thing was to fall upon a method of calculating such a table as was wanted, which indeed appeared an Herculean labour. The first observation was, that whatever numbers might be made use of to represent the ratios of others, the ratio of equality, or that of unity to unity must be 0; for that ratio has properly no magnitude, neither increasing nor diminishing any other ratio to which it is adapted, or from which it is subtracted.

2. The second observation was, that though any number might be chosen at pleasure to represent the ratio of any other number to unity, yet when once this choice was made, all the other numbers representing the different ratios must be determined by it. Thus, if the ratio of 10 to 1 be represented by 1, then the ratio of 100 to 1 must be 2, and that of 1000 to 1 must be 3, &c.; or if 2 was chosen to represent the ratio of 10 to 1, then that of 100 to 1 must be 4, that of 1000 to 1 must be 6, &c.; and no other numbers could possibly be used.

3. As those artificial numbers represented, or were proportional to, the ratios of the natural numbers to unity, they must be expressions of the numbers of some smaller equal ratios contained in the former and larger ones. Thus, if we make 1 the representative of the ratio of 10 to 1; then 3, which represents the ratio of 1000 to 1, will likewise express the number of ratios of 10 to 1, which are contained in that of 1000 to 1. If instead of 1, we make 1000 to be the ratio of 10 to 1; then 3000 will express the ratio of 1000 to 1, and this number 3000 will express the number of small ratios of the 1000th root of 10 to 1 contained in the ratio of 1000 to 1; and so on for any larger number, as 10,000, 100,000, or 10,000,000, &c. Thus, if instead of 1000 we make 10,000,000 the representative of the ratio of 10 to 1, then the unit will represent a very small ratio, of which there are 10,000,000 contained betwixt 1 and 10, and which ratio could not really be had without extracting a root which involved

N^o 183.

in itself, 10,000,000 of times would only make up 10; which root may perhaps be most intelligibly expressed thus, $10,000,000 \sqrt{10}$. If the ratio of 10 to 1 contained 10,000,000 of these roots, it is evident that the ratio of 100 to 1 must contain 20,000,000, that of 1000 would have 30,000,000, &c.; of consequence, the ratio of 100 to 1 will be expressed by 20,000,000, of 1000 to 1 by 30,000,000, &c.—Hence, as these artificial numbers represent the ratios of natural numbers to unity, or are proportional to them, they are very properly called the *logarithms* of these numbers, or the *numbers of their ratios*; because they really do express this number of ratios.

The relation of logarithms to natural numbers may perhaps more intelligibly be explained by two series of numbers, one in an arithmetical, and the other in geometrical, progression. Thus,

Logarithms, 0	1	2	3	4	5	6	7	8
Nat. numb. 1	2	4	8	16	32	64	128	256

Or,

Logarithms, 0	1	2	3	4	5	6
Nat. numb. 1	10	100	1000	10,000	100,000	1,000,000

In either of these series it is evident, that by adding any two terms of the upper line together, a number will be had which indicates that produced by multiplying the corresponding terms of the lower line. Thus, in the first two series, suppose we wish to know the product of 4×32 . In the upper line we find 2 standing over the number 4, and 5 over 32; adding therefore 5 to 2 we find 7, the sum of this addition, standing over 128, the product of the two numbers. In like manner, if we wish to divide 256 by 8, from the number which stands over 256, viz. 8, subtract that which stands over 8, viz. 3; the remainder 5, which stands over 32, shows that the latter is the quotient of 256 divided by 8. Let it be required to involve 4 as high as the biquadrate or 4th power: Multiply 2, the number which stands over 4, by the index of the power to which the number is to be involved; which index is 4: the product 8, standing over 256, shows that this last number is the biquadrate of 4 required. Lastly, let it be required to extract the cube root of 64; divide the number 6, which stands over 64, by 3, the index of the root you wish to extract; the quotient 2, standing over 4, shows that 4 is the root sought.

These examples are sufficient to show the great utility of logarithms in the most tedious and difficult parts of arithmetic. But though it is thus easy to frame a table of logarithms for any series of numbers going on in geometrical progression, yet it must be far more difficult to frame a general table in which the logarithms of every possible series of geometricals shall correspond with each other. Thus, though in the above series we can easily find the logarithm of 4, 8, &c. we cannot find that of 3, 6, 9, &c.; and if we assume any random numbers for them, they will not correspond with those which have already been assumed for 4, 8, 16, &c. In the construction of every table, however, it was evident, that the arithmetical or logarithmic series ought to begin with 0; for if it began with unity, then the sum of the logarithms of any two numbers must be diminished by unity before we could find the logarithm of the product. Thus,

Logar. 1	2	3	4	5	6	7	8	9
Nat. N. 1	2	4	8	16	32	64	128	256

Here

Here let it be required to multiply 4 by 16; the number 3 standing over 4, added to 5 which stands over 16, gives 8 which stands over 128: but this is not just; so that we must diminish the logarithm by 1, and then the number 7 standing over 64 shows the true product. In like manner it appears, that as we descend below unity in a logarithmic table, the logarithms themselves must begin in a negative series with respect to the former; and thus the logarithm of 0 will always be infinite; negative, if the logarithms increase with the natural numbers; but positive, if they decrease. For as the geometrical series must diminish by infinite divisions by the common ratio, the arithmetical one must decrease by infinite subtractions, or increase by infinite additions of the common difference.

This property of numbers was not unknown to the ancient mathematicians. It is mentioned in the works of Euclid; and Archimedes made great use of it in his *Arenarius*, or treatise on the number of the sands: and it is probable that logarithms would have been much sooner invented, had the real necessity for them been sooner felt; but this did not take place till the end of the 16th century, when the construction of trigonometrical tables, and solution of perplexed astronomical problems, rendered them absolutely indispensable.

About this time it is probable that many people wished to see such tables of numbers, and were making attempts to construct them; but the invention is certainly due to Lord Napier, baron of Merchiston in Scotland. The invention is by some indeed ascribed to Longomontanus; but with very little probability, as he never published any thing of the kind, nor laid claim to the invention, though he lived to see the publication of Baron Napier's tables. Concerning this invention we are told, that "one Dr Craig a Scotchman, coming out of Denmark into his own country, called upon Baron Napier, and told him of an invention of Longomontanus in Denmark, to save the trouble of the tedious multiplication and division in astronomical calculations; but could give no farther account of it than that it was by proportionable numbers. From this slight hint the baron immediately set about the work; and by the time that Dr Craig returned to call upon him, he had prepared a rude draught of it, which he called *Canon mirabilis Logarithmorum*; and this draught, with some alterations, was printed in 1614.

According to Kepler, one Juste Byrge, assistant astronomer to the landgrave of Hesse, either invented or projected logarithms long before Baron Napier, and composed a table of sines for every two seconds of the quadrant; though, by reason of his natural reservedness, he never published any thing to the world. But whatever might have been in this, it is certain that the world is indebted for logarithms to Baron Napier, who died in the year 1618. This nobleman likewise made considerable improvements in trigonometry; and the frequent numerical computations he had occasion for in this branch, undoubtedly contributed to his invention of the logarithms, that he might save part of the trouble in these calculations. His book published in 1614 was intitled *Mirifici Logarithmorum Canonis descriptio*. At this time he did not publish his method of constructing the numbers until

the sense of the learned should be known. In other respects the work is complete, containing all the logarithms of the natural numbers to the usual extent of logarithmic tables; with the logarithmic sines, tangents, and secants, for every minute of the quadrant, directions for using the tables, &c.

This work was published in Latin; but was afterwards translated into English by Mr Edward Wright, inventor of the principles of what has been falsely called *Mercator's Sailing*. The translation was sent to his lordship at Edinburgh, and returned with his approbation and some few additions. It was published in 1616, after Mr Wright's death, with a dedication to the East India Company, by his son Samuel Wright, and a preface by Mr Briggs, who afterwards distinguished himself so much in bringing logarithms to perfection. In this translation Mr Briggs also gave the description and draught of a scale invented by Mr Wright, as well as other methods invented by himself, for finding the intermediate proportional numbers; the logarithms already found having been only printed for such numbers as were the natural sines of each minute.

Mr Wright's translation was reprinted in 1618, with a new title-page, and the addition of 16 pages of new matter, "showing the method of calculating triangles, as well as a method of finding out such lines and logarithms as are not to be found in the canons."

Next year John Speidell published his *New Logarithms*, in which were some remedies for the inconveniences attending Lord Napier's method. The same year also Robert Napier, the Baron's son, published a new edition of his father's book, entitled *Canonis Logarithmorum Descriptio*; with another concerning the method of constructing them, which the Baron had promised; together with some other miscellaneous pieces, which his father had likewise composed along with Mr Briggs. In 1620 also, a copy of these works was printed at Lyons in one volume, by Bartholomew Vincent a bookseller there; but this publication seems to have been but little known, as Wingate, who carried logarithms to France four years after, is said to have been the first who introduced them into that country.

The *Curfus Mathematicus* published at Cologne in 1618 or 1619 by Benjamin Ursinus, mathematician to the elector of Brandenburg, contains a copy of Napier's logarithms, together with some tables of proportional parts. In 1624 he published his *Trigonometria*, with a table of natural sines and their logarithms, according to Lord Napier's method, to every ten seconds in the quadrant. The same year a book on logarithms was published at Marburg by the celebrated Kepler, of the same kind with those of Napier. Both of these begin at 90° or the end of the quadrant; and, while the sines decrease, the logarithms gradually increase; till at the beginning of the quadrant, or 0, the logarithm is infinite. The only difference betwixt the logarithms of Napier and Kepler is, that in the former the arc is divided into equal parts, differing by one minute each; and consequently their sines to which the logarithms are adapted are interminate numbers represented only by approximating decimals: but in Kepler's table, the radius is divided into equal parts, which are considered as perfect and terminate sines, having equal differences, and to which the logarithms are here

adapted. A treatise of some extent was prefixed to the work; in which the construction and use of logarithms is pretty largely treated of. In the year 1627 the same author introduced logarithms into his Rudolphine Tables, together with several others, *viz.* 1. A table similar to that already mentioned; only that the column of sines or absolute numbers is omitted, and another added in its stead, showing what part of the quadrant each arc is equal to; *viz.* the quotient arising from the division of the whole quadrant by each given arc, and expressed in integers and sexagesimal parts. 2. Napier's table of logarithmic sines to every minute of the quadrant; as also two other smaller tables adapted for the calculation of eclipses and the latitude of planets. In this work Juitus Byrgius is mentioned as having invented logarithms before Napier.

The kind of logarithms now in use were invented by Mr Henry Briggs professor of geometry in Gresham college, London, at the time they were first discovered by Napier. As soon as the logarithms of Napier were published, Mr Briggs directed his attention to the study and improvement of them; and his employment in this way was announced in a letter to Mr Usher, afterwards the celebrated archbishop, in the year 1615. By him the scale was changed, and 0 was made the logarithm of 1; but lord Napier informed Mr Briggs that he had already thought of such a scheme, but chose rather to publish the logarithmic tables he had completed, and to let those alone until he should have more leisure as well as better health. At an interview betwixt Lord Napier and Mr Briggs, the present plan seems to have been settled; and in consequence of his lordship's advice, Mr Briggs made some alteration in the method of constructing his tables from that which he had begun. A correspondence also took place betwixt his lordship and Mr Briggs, which continued during the lifetime of the former. It appears, however, that, whether Mr Briggs thought of this alteration before lord Napier or not, he certainly was the person who first published it to the world; and some reflections have been thrown upon his lordship for not making any mention of the share which Mr Briggs had in it.

In 1617 Mr Briggs published his first thousand logarithms under the title of *Logarithmorum Chilias Primæ*; and in 1620 Mr Edward Gunter published his Canon of Triangles, containing the artificial or logarithmic sines and tangents for every minute, to seven places of figures besides the index; the logarithm of the radius being 10,000, &c. These were the first tables of logarithmic sines, tangents, &c. which made their appearance upon the present plan; and in 1623 they were reprinted in his book de *Scilore et Radio*, along with the *Chilias Prima* of Mr Briggs. The same year Mr Gunter applied these logarithms of numbers, sines, and tangents, to straight lines drawn on a ruler; and with these the proportions in common numbers, as well as in trigonometry, were solved by the mere application of a pair of compasses; a method founded upon this property, that the logarithms of the terms of equal ratios are equally different. The instrument is now well known by the name of the two-feet Gunter's Scale. By the same methods he also greatly improved the sector. He was also the first who used the word *cosine*

for the sine of the complement of an arc; and he introduced the use of arithmetical complements into the logarithmical arithmetic. He is said also to have first suggested the idea of the logarithmic curve, so called because the segments of its axis are the logarithms of the corresponding ordinates.

The logarithmic lines were afterwards drawn in many other ways. Wingate, in 1627, drew them upon two separate rulers sliding by each other, in order to save the use of compasses in resolving proportions. In 1627 also, they were applied by Mr Oughtred to concentric circles; about 1650, in a spiral form, by one Mr Milburne of Yorkshire; and in 1657, they were applied on the present sliding-rule by Mr Seth Partridge.

The knowledge of logarithms was diffused in France by Mr Edmund Wingate, as already related, though not carried originally thither by him. Two small tracts were published by him in French, and afterwards an edition in English, all printed in London. In the first of these he mentions the use of Gunter's Ruler; and in the other that of Briggs's Logarithms, with the canon of artificial sines and tangents. There are likewise tables of these sines, tangents, and logarithms, copied from Gunter.

From the time that Mr Briggs first began to study the nature of logarithms, he applied to the construction of tables with such assiduity, that by the year 1624 he published his *Arithmetica Logarithmica*, containing the logarithms of 30,000 natural numbers to 14 places of figures besides the index; *viz.* from 1 to 20,000, and from 90,000 to 100,000, together with the differences of the logarithms. According to some, there was another *Chilias*, *viz.* from 100,000 to 101,000; but this does not seem to be well authenticated. In the preface to this work, he gives an account of the alteration made in the scale by Lord Napier and himself; and earnestly solicits other persons to undertake the task of filling up the intermediate numbers; offering to give instructions, and to afford paper ready ruled for the purpose. He gives also instructions at large in the preface for the construction of logarithmic tables. Thus he hoped to get the logarithms of the other 70,000 natural numbers completed; while he himself, being now pretty far advanced in years, might be at liberty to apply to the canon of logarithmic sines, &c. which was as much wanted by mathematicians as the others. His wishes were accomplished by Adrian Vlaeq or Flaek of Gouda in Holland, who completed the numbers from 20 to 90,000; and thus the world was furnished with the logarithms of all natural numbers from 1 to 100,000; but those of Vlaeq were only done to 10 places of figures. To these was added a table of artificial sines, tangents, and secants, to every minute of the quadrant. Besides the great work already mentioned, Mr Briggs completed a table of logarithmic sines and tangents for the 100th part of every degree, to 14 places of figures besides the index; and a table of natural sines for the same parts to 15 places, with the tangents and secants to 10 places, and the methods of constructing them. He designed also to have published a treatise concerning the uses and application of them, but died before this could be accomplished. On his death-bed he recommended this work to Henry Gellibrand professor of astronomy.

astronomy in Gresham college, in which office he had succeeded Mr Gunter. Mr Briggs's tables above mentioned were printed at Gouda, and published in 1633; and the same year Mr Gellibrand added a preface with the application of logarithms to plane and spherical trigonometry, the whole being denominated *Trigonometria Britannica*: and besides the arcs in degrees and hundredth parts, has another table containing the minutes and seconds answering to the several hundredth parts in the first column.

The *Trigonometria Artificialis* of Vlacq contains the logarithmic fines and tangents to 10 places of figures, to which is added Briggs's first table of logarithms from 1 to 20,000, besides the index: The whole preceded by a description of the tables, and the application of them to plane and spherical trigonometry, chiefly extracted from Briggs's *Trigonometria Britannica* already mentioned. In 1635, Mr Gellibrand also published a work, intitled, *An Inquisition Trigonometrical*, containing the logarithms of the first 10,000 numbers, with the natural fines, tangents, and secants; and the logarithmic fines and tangents for degrees and minutes, all to seven places of figures besides the index; likewise other tables proper for navigation, with the uses of the whole. Mr Gellibrand died in 1636, in the 40th year of his age.

A number of other people have published books on logarithms, which we cannot now particularly enumerate. Some of the principal are:

1. A treatise concerning Briggs's logarithms of common numbers from 1 to 20,000, to 11 places of figures, with the logarithmic fines and tangents but only to eight places. By D. Henrion at Paris, 1626.

2. Briggs's logarithms, with their differences to 10 places of figures, besides the index for all numbers to 100,000; as also the logarithmic fines, tangents, and secants, for every minute of the quadrant, with the explanation and uses in English. By George Miller, London, 1631.

3. *Trigonometria*, by Richard Norwood, 1631; containing Briggs's logarithms from 1 to 10,000, as well as for the fines, tangents, and secants to every minute, both to several places of figures besides the index. The author complains very much of the unfair practices of both the former authors.

4. *Directorium Generale Uranometricum*; by Francis Bonaventura Cavalieri. Bologna, 1632. In this are Mr Briggs's tables of logarithmic fines, tangents, secants, and versed fines each to eight places of figures for every second of the first 5 minutes, for every 5 seconds from 5 to 10 minutes, for every 20 seconds from 20 to 30 minutes, for every 30 seconds from 30 minutes to 15 degree, and for every minute in the rest of the quadrant. It contains also the logarithms of natural numbers from 1 to 10,000, with the first table of versed fines that ever was published. The author likewise gives the first intimation of the method of finding the arcs or spherical surface contained by various arcs described on the surface of a sphere.

5. In 1643 appeared the *Trigonometria* of the same author, containing the logarithms of the natural numbers from 1 to 1000, with their differences to eight places of figures; likewise a table of natural logarithmic fines, tangents, and secants; the former to seven, the latter to eight, places of figures; viz. to

every 10' of the first 30', to every 30' from 30' to 1°, and the same for their complements, or backwards thro' the last degree of the quadrant; the intermediate 88° being only to every minute.

6. *Tabule Logarithmicæ*; by Mr Nathaniel Rowe, pastor of Benaire in Suffolk: Lond. 1633. In this work are contained Briggs's logarithms of natural numbers from 1 to 100,000, to eight places of figures; likewise the logarithmic fines and tangents to every 100th part of degrees to ten places.

7. *Clavis Univerſa Trigonometria*; Hamburg, 1634: containing tables of Briggs's logarithms from 1 to 2000; and of fines, tangents, and secants, for every minute, both for seven places.

8. *Trigonometria Britannica*, by John Newton, London, 1658. In this the logarithmic tables of natural numbers were reduced to their most convenient form; the author having availed himself of the labours of Wingate and Roe, uniting their several methods, and disposing of the whole as in the best logarithmic tables used at present. It contains likewise the logarithmic fines and tangents to eight figures besides the index; for every hundredth part of a degree, with the differences, and for thousandth parts in the first three degrees. He censures the unfair practices of some former publishers of logarithms; particularly of Vlacq already mentioned.

9. *Mathesis Nova*, by John Caramuel, 1670. This contained 1000 logarithms, both of the forms of Napier and Briggs, as well as 1000 of what he calls *perfect logarithms*, viz. those of Briggs's first method of construction; which differs from the last only in this, that the last increases, whilst the first decreases; the radix or logarithm of the ratio of 10 to 1 being the very same in both.

10. Sherwin's Mathematical Tables, published in 8vo, form the most complete collection of any; containing, besides the logarithms of all numbers to 1:1,000, the fines, tangents, secants, versed fines both natural and logarithmic, to every minute of the quadrant. The first edition was printed in 1706; but the third, published in 1742 and revised by Gardiner, is looked upon to be superior to any other. The fifth and last edition, published in 1771, is so incorrect, that no dependence can be placed upon it.

11. Tables of logarithms from 1 to 102,100, and for the fines and tangents to every 10 seconds of each degree in the quadrant; as also for the fines of the first 72 minutes to every single second, with other useful and necessary tables. By Gardiner, London, 1742. This work contains a table of logarithmic logarithms, and three smaller tables to be used for finding the logarithms of numbers to 20 places of figures. Only a small number of these tables was printed, and that by subscription; and they are now in the highest esteem for accuracy and usefulness. An edition of these tables was printed at Avignon in France in 1770, with the addition of fines and tangents for every single second in the first four degrees, and a small table of hyperbolic logarithms, taken from a treatise upon fluxions by the late Mr Thomas Simson. The tables are to seven places of figures, but somewhat less correct than those published by Gardiner himself.

12. An Antilogarithmic Canon for readily finding the number corresponding to any logarithm, was begun by

Construc-
tion of
Logarithms

the algebraist Mr Harriot, who died in 1621; and completed by Mr Walter Warner, the editor of Harriot's works, before 1640, but never was published for want of encouragement to print it. In 1714 a small specimen of such a canon appeared in the Philosophical Transactions for that year by Mr Long of Oxford; and in 1742 a complete Antilogarithmic Canon appeared by Mr James Dodson, in which the numbers corresponding to each logarithm from 1 to 100,000 are computed to 11 places of figures.

12. In 1783 were published M. Callet's tables at Paris; which for the elegance of the workmanship are much superior to any thing of the kind that ever appeared, though their accuracy is not esteemed equal to that of some others. The work is a neat volume small 8vo. It contains a treatise on logarithms; with their uses and application to various sciences; as trigonometry, astronomy, and navigation; a table of logarithms from 1 to 102,960, with the differences; a table of sines and tangents for every single second of the first two degrees, and for every 10 seconds of the rest of the quadrant; with tables of logistical and hyperbolic logarithms, and some others for determining the longitude at sea.

SECT. II. Different methods of constructing Logarithms.

§. 1. Napier's method.

THE logarithms first thought of by Lord Napier were not adapted to the natural series of arithmetical numbers 1, 2, 3, &c. because he did not then intend to adapt them to every kind of arithmetical calculation, but only to that particular operation which had called for their immediate construction, viz. the shortening of trigonometrical operations: he explained the generation of logarithms, therefore, in a geometrical way. Both logarithms, and the quantities to which they correspond, in his way, may be supposed to proceed from the motion of a point; which, if it moves over equal spaces in equal times, will produce a line increasing equally: but if, instead of moving over equal spaces in equal times, the point describes spaces proportional to its distances from a certain term, the line produced by it will then increase proportionably. Again, if the point moves over such spaces in equal times, as are always in the same constant ratio to the lines from which they are subducted, or to the distance of that point at the beginning of the lines, from a given term in that line, the line so produced will decrease proportionably. Thus, let ac be to ao , cd to co , ef to fo , and fg to fo , always in a certain ratio, viz. that of QR to QS , and let us suppose the point P to set f out from a , describing the distances ac , cd , de , &c. in equal spaces of time, then will the line ao decrease proportionably.

In like manner, the line oa , (fig. 12.) increases proportionally, if the point p , in equal times, describes the spaces ac , cd , de , fg , &c. so that ac is to ao , cd to co , de to do , &c. in a constant ratio. If we now suppose a point P describing the line AG (fig. 4.) with a uniform motion, while the point p describes a line increasing or decreasing proportionally, the line

AP , described by P , with this uniform motion, in the same time that oa , by increasing or decreasing proportionally, becomes equal to op , is the logarithm of op . Thus AC , AD , AE , &c. are the logarithms of oc , od , oe , &c. respectively: and oa is the quantity whose logarithm is supposed equal to nothing.

We have here abstracted from numbers, that the doctrine may be the more general; but it is plain, that if AC , AD , AE , &c. be supposed 1, 2, 3, &c. in arithmetic progression; oc , od , oe , &c. will be in geometric progression; and that the logarithm of oa , which may be taken for unity, is nothing.

Lord Napier, in his first scheme of logarithms, supposes, that while op increases or decreases proportionally, the uniform motion of the point P , by which the logarithm of op is generated, is equal to the velocity of p at a ; that is, at the term of time when the logarithms begin to be generated. Hence logarithms, formed after this model, are called Napier's Logarithms, and sometimes Natural Logarithms.

When a ratio is given, the point p describes the difference of the terms of the ratio at the same time. When a ratio is duplicate of another ratio, the point p describes the difference of the terms in a double time. When a ratio is triplicate of another, it describes the difference of the terms in a triple time; and so on. Also, when a ratio is compounded of two or more ratios, the point p describes the difference of the terms of that ratio in a time equal to the sum of the times in which it describes the differences of the terms of the simple ratios of which it is compounded. And what is here said of the times of the motion of p when op increases proportionally, is to be applied to the spaces described by P , in those times, with its uniform motion.

Hence the chief properties of logarithms are deduced. They are the measures of ratios. The excess of the logarithm of the antecedent above the logarithm of the consequent, measures the ratio of those terms. The measure of the ratio of a greater quantity to a lesser is positive; as this ratio, compounded with any other ratio, increases it. The ratio of equality, compounded with any other ratio, neither increases nor diminishes it; and its measure is nothing. The measure of the ratio of a lesser quantity to a greater is negative; as this ratio, compounded with any other ratio, diminishes it. The ratio of any quantity A to unity, compounded with the ratio of unity to A , produces the ratio of A to A , or the ratio of equality; and the measures of those two ratios destroy each other when added together; so that when the one is considered as positive, the other is to be considered as negative. By supposing the logarithms of quantities greater than oa (which is supposed to represent unity) to be positive, and the logarithms of quantities less than it to be negative, the same rules serve for the operations by logarithms, whether the quantities be greater or less than ao . When op increases proportionally, the motion of p is perpetually accelerated; for the spaces ac , cd , de , &c. that are described by it in any equal times that continually succeed after each other, perpetually increase in the same proportion as the lines ao , oc , od , &c. When the point p moves from a towards o , and op decreases proportionally, the motion of p is perpetually retarded; for the spaces described by it in any equal times that

Construc-
tion of
Logarithms

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fig. 1, 2.

Construc-
tion of
Logarithms

continually succeed after each other, decrease in this case in the same proportion as op decreases.

If the velocity of the point p be always as the distance op , then will this line increase or decrease in the manner supposed by Lord Napier; and the velocity of the point p being the fluxion of the line op , will always vary in the same ratio as this quantity itself. This, we presume, will give a clear idea of the genesis or nature of logarithms; but for more of this doctrine, see Maclaurin's Fluxions.

The construction of his tables of logarithms was first published in his posthumous work of 1619. The construction of his canon was chiefly effected by generating, in an easy manner, a series of proportional numbers, and their arithmeticals or logarithms; and then finding by proportion the logarithms of the natural sines from those of the nearest numbers among the original proportionals. Beginning then at the radius 10,000,000, he first constructs several descending geometrical series, of such a nature that they are quickly formed by an easy addition or subtraction, or division by 2, 10, 100, &c. His first table consists of proportionals in the ratio of 10,000,000 to 9,999,999; the method of doing which may be easily understood from the following example: Suppose it were required to find a series of descending proportionals in the ratio of 100 to 99; it may be done by adding two cyphers to each of the two first terms, and continually adding 1 to the decimal place farthest to the right hand. Thus the first term will be 100.00, the second 99.00, the third 98.01, the fourth 98.03, &c. Napier's first table contained 100 terms of a series, as we already mentioned, in the proportion of 10,000,000 to 9,999,999. The first term of which series was 10,000,000.0000000; the second 9,999,999.0000000; the third was 9,999,998.0000001, and so on till the 100th term, which was 9,999,900.0004950. The second table consisted of 50 numbers nearly in the proportion of 100,000 to 99,999; and this was formed by substituting the units 1, 3, &c. in the third decimal place instead of the last place towards the right hand.

The reason of constructing this table was, that he might have a series in the proportion of his first term of the former to the last term of it, viz. of 100,000 to 99,999; and the last of the second series was 9995001.222927. In all these series the method of finding the terms is exactly the same. Thus in the first example, where we begin with 100, each term decreases by the 100th part of the former; and this 100th part is found by removing the number two places of figures lower, and subtracting them from the former terms. Thus 99 is less than 100 by unity, which is the 100th part of the latter; the next term is less than 99 by the 100th part of 99, and is therefore 98.01. But the division by 100 can be performed without any trouble, only setting the decimal point two places farther forward, as that by 10 is performed by setting it one place farther forward; thus $9 \div 10 = .9$; $99 \div 100 = .99$. Now by subtracting 99 from 100, we have 98.01 for the third term of the series. To find the fourth term then, remove the decimal point two figures farther to the right hand, and subtract it from the former; and we have then 97.0299 for the fourth term of the series. Thus we see, that the number of decimal places must continually increase; but as in this series we want no more than two decimal

Construc-
tion of
Logarithms

places instead of 97,0299, the term is made 97.03, as the nearest number which has only two decimal places, and differs from the truth only by one thousandth part. In like manner, in the long string of cyphers, the fourth term of the series differs somewhat, but very little, from the truth; and this must always be the case while the radius is supposed to consist of any finite number of parts; though, by going on for a very long time in this way, the error, by being continually repeated and augmented at every term, would at last become perceptible; and therefore none of these series are carried on to a very great length.

His next step was to construct a third table consisting of 69 columns; and each column of 21 numbers or terms in the continual proportion of 10000 to 9995; that is, nearly as the first term of the second table is to its last term. As this proportion is the 2000th of the whole, the method of finding the terms will be by dividing each upper number by 2, and removing the figures of the quotient three places lower, and then subtracting them. In this way, however, it is proper to collect only the first column of 21 numbers, the last of which will be 9900473.5780; but the first, second, and third, &c. numbers in all the other columns are in the continual proportion of 100 to 99, or nearly of the first to the last in the first column; whence these are to be found by removing the figures two places lower, and then subtracting them, as has already been explained.

By these three tables, his lordship was furnished with about 1600 proportionals, nearly coinciding with all the natural series from 90 to 30 degrees. To obtain the logarithms of those proportionals, he demonstrated and applied some of the properties and relations of the numbers and logarithms; the principal of which are, 1. That the logarithm of any fine is greater than the difference between that fine and the radius, but less than that difference when increased in the proportion of the fine to the radius. 2. That the difference between the logarithms of two fines is less than the difference of the fines increased in the proportion of the lesser fine to the radius, but greater than the difference of the fines increased in the proportion of the greater fine to the radius. These properties now served him as theorems for finding the logarithms themselves in an easy manner. From the first of them it appeared, that the radius being 10,000,000, the first term of the table, the logarithm of 9,999,999, the second term, must be greater than the difference betwixt that term and the radius, which is 1, but less than the difference when increased in the proportion of the fine to the radius; but this proportion is only one ten millionth part, for $9,999,999 \times 1.0000001 = 10,000,000$; whence the logarithm of the radius or 10,000,000 being 0, the logarithm of 9,999,999 the second term will be between 1 and 1.0000001, or very nearly 1.00000005, this being the arithmetical mean betwixt 1 and 1.0000001. This will also be the common difference betwixt every two succeeding terms in the first table; because all the terms there are in the same proportion of 10,000,000 to 9,999,999. Hence by the continual addition of this logarithm we have the logarithms of the whole series, and therefore that of the last term of the series viz. 9999900.0004950 will be 100.000005.

The second table, as we have already said, consists

Construc-
tion of
Logarithms

of a series of numbers in the continual proportion of 100000 to 99999, whence the first term being 10,000,000 the second will be 9,999,900; the difference betwixt this and the last term of the former series is .0004950. But by the second theorem, the difference between the logarithms of 9,999,900,0004950 and 9,999,900, the second term of the second table, will be less than .0004950, increased in the proportion of 99999 to 100000, but greater than .0004950, increased in the proportion of 9,999,900,0004950; that is to say, if we augment .0004950 by one hundred thousandth part, it will be greater than the difference betwixt the logarithms of the two terms. The limits, therefore, are here so extremely small, that we may account the difference betwixt the two terms and that of the logarithms themselves the same: adding therefore this difference .0004950 to 100,000,000, we have 100,000,000 for the logarithm of the second term, and likewise for the common difference of all the logarithms of the terms of the second table. — Again, by the same theorem, the difference between the logarithms of this last proportional of the second table and the second term in the first column of the third table, will be found to be 1.2235287; which added to the last logarithm, gives 5001.2485387 for the logarithm of 9,995,000, the second term of the third table: and in a similar manner, by the same theorem, he finds the logarithms of all the other terms of the rest of the columns.

Thus our author completed what he calls his radical table, from which he found his logarithmic sines by taking, according to the second theorem, the sum and difference of each tabular sine, and the nearest number in the radical table. Annex then seven ciphers to the difference; divide the number by the sum, and half the quotient will be the difference between the logarithms of the tabular sine and radical number; and consequently, by adding or subtracting this difference to or from the logarithm of the natural number, we have the logarithmic sine required.

In this manner were completed the logarithmic sines from radius or sine of 90° to the half of it, or sine of 30°. To complete the other 30°, he observes, that the logarithm of the ratio of 2 to 1, or of one half the radius, is 6931469.22; that of the ratio of 4 to 1 is double of it; that of 8 to 1, triple of it, &c.; and thus going on to compute the logarithms of the ratio between 1 and 40, 80, 100, &c. to 10,000,000; then multiplying any given sine for an arc less than 30° by some of these numbers, he finds the product nearly equal to some number in the table; and then finds the logarithm by the second theorem as already directed.

Another, and much easier method, however, of performing the same thing is founded upon the following proportion, which he demonstrates, *viz.* that as half the radius is to the sine of half an arc, so is the cosine of the half arc to the sine of the whole arc; or as one half the radius is to the sine of any arc, so is the cosine of that arc to the sine of double the arc. Hence the logarithmic sine of an arc is found by adding the logarithms of half the radius and the sine of double the arc, and then subtracting the logarithmic cosine from the sum. In this way, he observes that the sines for full one half of the quadrant may be found, and the remainder by one easy division, or

addition and subtraction for each, as already directed.

Construc-
tion of
Logarithms

§. 2. Kepler's method of construction.

This was founded upon principles nearly similar to that of Napier. He first of all erects a system of proportions, and the measures of proportion, founded upon principles purely mathematical; after which he applies these principles to the construction of his table, containing only the logarithms of 1000 numbers. The propositions on which his method is founded are in substance the following.

1. All equal proportions equal among themselves are expressed by the same quantity, be the terms many or few; as the proportion of 2, 4, 8, &c. in geometrical progression is expressed by 2; and of 2, 6, 18, 54, &c. by 3.

2. Hence the proportion of the extremes is composed of all the proportions of the intermediate terms; thus the proportion of 2 to 8 its compounded of that 2 to 4, and of 4 to 8.

3. The mean proportional betwixt two terms divides that proportion into two equal ones. Thus the proportion between 2 and 32 is divided by the mean proportional 8 into two equal proportions of 4; for 2 is to 8, as 8 is to 32.

4. In any number of proportionals regularly increasing, the means divide the proportion of the extremes into one more than their own number. Thus, in the series 2, 4, 8, 16, the proportion of the extremes 2 and 16 is by the *two* means 4 and 8, divided into *three* proportions, *viz.* that betwixt 2 and 4, 4 and 8, 8 and 16. In like manner, in the series 3, 6, 18, 54, 162, 486, the proportion betwixt 3 and 486 is divided by the four means into the five proportions of 3 to 6; 6 to 18; 18 to 54; 54 to 162; and 162 to 486.

5. The proportion betwixt any two terms is divisible into any number of parts, until these become less than any assignable quantity. Thus the proportion of 2 to 8 is divisible, by multiplying the two together and extracting the square root, into two parts by the number 4: by multiplying 2 and 4 together, and extracting the square root, and doing the same with 4 and 8, the proportion would be divided into four parts, *viz.* $2/\sqrt{8}$, $4/\sqrt{32}$, &c. or in numbers, 2 : 2.813, &c. 14 : 5.655, &c.: 8.

6. By dividing the ratios in this manner, the elementary part will become at last so small, that it may be denominated by the mere difference of terms of that element. This is evident from the diminution of the ratios or proportions already instanced: for the proportion between 2 and 2.813 is only 1.406, &c. and if we were to find a mean proportional betwixt 2 and 2.813, the ratio betwixt that proportional and 2 would be much less. But it must always be remembered, that such *evanescent* quantities, as they are called, cannot give us any conclusion with absolute exactness, however they may answer every useful purpose to us: for it is evident that neither mean proportional nor ratio can ever be found exactly; and therefore the error accumulated in all the operations must become very considerable, if any circumstance shall happen to make it appear.

7. In three continued proportionals, the difference of

Construc-
tion of
Logarithms

Construc-
tion of
Logarithms

of the two first has to the difference between the two last the same proportion that the first term has to the second, or the second to the third. Thus, in the three terms, 4, 8, 16, the difference between the two first terms 4 and 8, viz. 4, is in proportion to 8; and the difference between the two last, as 4 is to 8, or 8 to 16.

8. In continued proportionals, the greatest terms have the greatest differences, and *vice versa*. Thus the difference between 8 and 16 is evidently greater than between 2 and 4 or 4 and 8.

9. If the difference betwixt the two greatest terms be made the measure of the proportion between them, the difference between any two others will be less than the true measure of their proportion. Thus in the series 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, &c. where the difference 2 betwixt the two greatest terms expresses their true proportion, it is plain, that the difference 1 betwixt 2 and 1 is less than their ratio, as well as between $\frac{1}{2}$ and $\frac{1}{4}$, &c.

10. In any series of proportionals, if the difference betwixt the greatest term and one not immediately next to it, be taken as the measure of the proportion, then the proportion betwixt the greatest term and any other greater than the term before taken, will be less than the difference of those terms; but the proportion which is between the greatest term and any one less than that first taken, will be greater than their difference. As proportionals of this kind do not readily occur, we shall, in order to avoid obscurity, shew once for all, that there is a possibility of finding geometrical proportionals of such a nature, that the ratio may be equal to the difference betwixt the greatest and third, or any other term distant from it. Thus let us begin with any two numbers we please, suppose 9 and 10: though these are in the natural arithmetical proportion, yet if we make the ratio 1.111, they will also be geometrically proportional, and the series will run thus:

1st	2d	3d	4th	5th	6th
term	term	term	term	term	term

10 : 9 : 8.099 : 7.289 : 6.560 : 5.904, &c.

Here the difference betwixt the first and third terms is 1.901, which is greater than the ratio; that betwixt the second and fourth, viz. 1.711, is still greater, but nearer to it than the former; the difference between the third and fifth terms, viz. 1.539, still approximates, as does that between the fourth and sixth, viz. 1.385; and indeed by continuing this series only for two terms longer, the difference will become smaller than the ratio. It is not worth while, however, to seek for series of this kind, as the present proposition will now be sufficiently intelligible without any farther illustration.

11. If quantities be arranged according to the order of their magnitudes, and if any two successive proportions of these be equal, the three successive terms which constitute them will also be equal. Thus, if the two quantities 12 and 8 constitute the proportion $\frac{12}{8}$, and each of them be lessened by 6, the half of 12, we have the proportion $\frac{6}{2}$; which is more than double the original proportion; for $\frac{12}{8} = 3$, and $\frac{6}{2} \times \frac{1}{2} = \frac{3}{1} = 3$.

12. When quantities are placed in the order of their magnitudes, if the intermediate magnitudes lying between any two terms be not among the mean proportion-

nals which can be interposed betwixt these two terms, then these intermediates will not divide the proportion of those two terms into commensurable proportions. Thus in the magnitudes 343 : 216 : 125 : 64 : 27 : 8, neither of the two intermediate terms 125 and 64 are mean proportionals betwixt 27 and 216, nor do they divide the proportion betwixt these into commensurable parts.

13. All the proportions taken in order, which are between expressible terms that are in arithmetical proportion, are incommensurable to one another; as between 8, 13, and 18.

14. When quantities are placed in the order of their magnitude, if the difference between the two greatest be made the measure of their proportion, the difference between any two others will be less than the measure of their proportion; and if the difference between the two least terms be made the measure of their proportion, the differences of the rest will be greater than the measure of the proportion between their terms.

15. If the measure of proportion between the greatest exceed their difference, then the proportion of this measure to the difference will be less than that of a following measure to the difference of its terms; because proportionals have the same ratio.

16. If three equidifferent quantities are taken in order, the proportion between the extremes is more than double that betwixt the two greater terms. Hence it follows, that half the proportion of the extremes is greater than the proportion between the greatest terms, but less than the proportion of the two least.

17. If two quantities constitute a proportion, and each be lessened by half the greater, the remainder will constitute a proportion more than double the former.

18. If 1000 numbers follow one another in the natural order, 1000, 999, 998, &c. and by continual multiplication and extraction of the square root we find mean proportionals, and thus *bisect*, as it is called, the ratio between the two greatest, so that the parts into which the ratio is divided become ultimately smaller than the excess of proportion betwixt the next two over the former (for 998 bears a greater proportion to 999 than 999 bears to 1000); the measure of this very small part or element of the proportion may be supposed to be the difference between 1000 and that mean proportional which is the other term of the element. Thus, for the sake of an easy explanation, let us suppose the numbers to be 10, 9, 8, &c. the ratio of 9 to 10 is 1.11, that of 9 to 8 is 1.125, the difference between which is .014, which we may call the elementary part of the ratios. By six extractions of the square root we have the mean proportional 9.985, &c. differing from 10 by no more than .015, which is very near the element just mentioned. The number of parts into which the ratio is thus divided is expressed by the 6th power of 2 or 64. Dividing therefore the ratio between 9 and 10 or 1.11 by 64, we have .017 for the elementary part thus obtained; which near coincidence with the real element, and the difference between 10 and the mean proportional itself, shews that in large numbers we may take the difference between the mean proportional and greatest term for the elementary part without any sensible error.

Suppose now, that the proportion between 1000

Construc-
tion of
Logarithms

and 998 be divided into twice the number of parts that the former was, it will be equally plain that the difference betwixt 1000 and the next mean proportional will be the measure of that element. Proceeding in like manner with the other numbers 1000 and 997, 1000 and 996, &c. it is evident, that by dividing into a proper number of parts, all the elements will be reduced to an equal degree of *fineness*, if we may so call it, and in calculations may be made use of without any fear of error.

19. The number of elementary parts being thus known which are contained in any proportion, it will be easy to find the ratios between those numbers which are in continued proportion to the first term of the series. Thus, having found the proportion between 1000 and 900,

we know also that of 1000 to 810, and 729;
And from 1000 to 800, also 1000 to 640, and to 512;
And from 1000 to 700, also 1000 to 490, and to 343;
And from 1000 to 600, also 1000 to 360, and to 216;
And from 1000 to 500, also 1000 to 250, and to 125.

Corol. Hence arises the precept for squaring, cubing, &c.; as also for extracting the square root, cube root, &c. out of the first figures of numbers. For it will be, As the greatest number of the chiliad as a denominator, is to the number proposed as a numerator, so is this to the square of the fraction, and so is this to the cube.

20. *Prop.* The proportion of a number to the first, or 1000, being known; if there be two other numbers in the same proportion to each other, then the proportion of one of these to 1000 being known, there will also be known the proportion of the other to the same 1000.

Corol. 1. Hence from the 15 proportions mentioned in prop. 18. will be known 120 others below 1000, to the same 1000.

For so many are the proportions, equal to some one or other of the said 15, that are among the other integer numbers which are less than 1000.

Corol. 2. Hence arises the method of treating the Rule-of-Three, when 1000 is one of the given terms.

For this is effected by adding to, or subtracting from, each other, the measures of the two proportions of 1000 to each of the other two given numbers, according as 1000 is, or is not, the first term in the Rule-of-three.

21. *Prop.* When four numbers are proportional, the

Let there be the fine 99970.1490 of an arc;
Its defect below radius is 29.8510 the covers. and less than logarithm fine;
Add the excess of the secant 29.8599

Sum 59.7109

its half or 29.8555 greater than the logarithm.

Therefore the logarithm is between } 29.8510 and
29.8555.

Precept 2. The logarithm of the fine being found, you will also find nearly the logarithm of the round or integer number which is next less than your fine with a fraction, by adding that fractional excess to the logarithm of the said fine.

Thus the logarithm of the fine 99970.149 is found to be about 29.854; if now the logarithm of the round N^o 184.

first to the second as the third to the fourth, and the proportions of 1000 to each of the three former are known, there will also be known the proportion of 1000 to the fourth number.

Corol. 1. By this means other chiliads are added to the former.

Corol. 2. Hence arises the method of performing the Rule-of-three, when 1000 is not one of the terms. Namely, from the sum of the measures of the proportions of 1000 to the second and third, take that of 1000 to the first, and the remainder is the measure of the proportion of 1000 to the fourth term.

Definition. The measure of the proportion between 1000 and any less number, as before described, and expressed by a number, is set opposite to that less number in the chiliad, and is called its *logarithm*, that is, the number (*λογος*) indicating the proportion (*μερος*) which 1000 bears to that number, to which the logarithm is annexed.

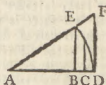
22. *Prop.* If the first or greatest number be made the radius of a circle, or *sinus totus*; every less number considered as the cosine of some arc, has a logarithm greater than the versed sine of that arc, but less than the difference between the radius and secant of the arc; except only in the term next after the radius, or greatest term, the logarithm of which by the hypothesis is made equal to the versed sine.

That is, if CD be made the logarithm of AC, or the measure of the proportion of AC to AD; then the measure of the proportion of AB to AD, that is, the logarithm of AB, will be greater than BD, but less than EF. And this is the same as Napier's first rule in page 44.

23. *Prop.* The same things being supposed; the sum of the versed sine and excess of the secant over the radius, is greater than double the logarithm of the cosine of an arc.

Corol. The logarithm cosine is less than the arithmetic mean between the versed sine and the excess of the secant.

Precept 1. Any fine being found in the canon of fines, and its defect below radius to the excess of the secant above radius; then shall the logarithm of the fine be less than half that sum, but greater than the said defect or covered fine.



number 99970.000 be required, add 149 the fractional part of the fine to its logarithm, observing the point, thus, 29.854 }
149 } is the logarithm of the round number 999700.000 nearly.

the sum 30.003

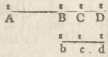
24. *Prop.* Of three equidifferent quantities, the measure

Construc-
tion of
logarithms

Construc-
tion of
Logarithms

sure of the proportion between the two greater terms, with the measure of the proportion between the two less terms, will constitute a proportion which will be greater than the proportion of the two greater terms, but less than the proportion of the two least.

Thus if AB, AC, AD, be three quantities having the equal differences BC, CD; and if the measure of the proportion of AD, AC be cd, and that of AC, AB, be bc; then the proportion of cd to cb will be greater than the proportion of AC to AD, but less than the proportion of AB to AC.



25. Prop. The said proportion between the two measures is less than half the proportion between the extreme terms: that is, the proportion between bc, cd, is less than half the proportion between AB, AD.

Corol. Since therefore the arithmetical mean divides the proportion into unequal parts, of which the one is greater and the other less than half the whole; if it be enquired what proportion is between these proportions, the answer is, that it is a little less than the said half.

An example of finding nearly the limits, greater and less, to the measure of any proposed proportion.—It being known that the measure of the proportion between 1000 and 900 is 10536.05, required the measure of the proportion 900 to 800, where the terms 1000, 900, 800, have equal differences. Therefore as 9 to 10, so 10536.05 to 11706.72, which is less than 11778.30, the measure of the proportion 9 to 8. Again, as the mean proportional between 8 and 10 (which is 8.9442719) is to 10, so 10536.05 to 11779.66, which is greater than the measure of the proportion between 9 and 8.

Axiom. Every number denotes an expresseble quantity.

26. Prop. If the 1000 numbers, differing by 1, follow one another in the natural order, and there be taken any two adjacent numbers, as the terms of some proportion; the measure of this proportion will be to the measure of the proportion between the two greatest terms of the chiliad, in a proportion greater than that which the greatest term 1000 bears to the greater of the two terms first taken, but less than the proportion of 1000 to the less of the said two selected terms.

So of the 1000 numbers taking any two successive terms, as 501 and 500, the logarithm of the former being 69114.92, and of the latter 69314.72, the difference of which is 199.80. Wherefore by the definition, the measure of the proportion between 501 and 500 is 199.80. In like manner, because the logarithm of the greatest term 1000 is 0, and of the next 999 is 100.05, the difference of these logarithms, and the measure of the proportion between 1000 and 999, is 100.05. Couple now the greatest term 1000 with each of the selected terms 501 and 500; couple also the measure 199.80 with the measure 100.05; so shall

Vol. X. Part I.

the proportion between 199.80 and 100.05 be greater than the proportion between 1000 and 501, but less than the proportion between 1000 and 500.

Corol. 1. Any number below the first 1000 being proposed, as also its logarithm; the differences of any logarithms antecedent to that proposed, towards the beginning of the chiliad, are to the first logarithm (viz. that which is assigned to 999) in a greater proportion than 1000 to the number proposed; but of those which follow towards the left logarithm, they are to the same in a less proportion.

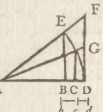
Corol. 2. By this means the places of the chiliad may easily be filled up, which have not yet had logarithms adapted to them by the former propositions.

27. Prop. The difference of two logarithms, adapted to two adjacent numbers, is to the difference of these numbers in a proportion greater than 1000 bears to the greater of those numbers, but less than that of 1000 to the less of the two numbers.

This 27th proposition is the same as Napier's second rule.

28. Prop. Having given two adjacent numbers of the 1000 natural numbers, with their logarithmic indices, or the measures of the proportions which those absolute or round numbers constitute with 1000 the greatest; the increments or differences of these logarithms will be to the logarithm of the small element of the proportions, as the secants of the arcs whose co-sines are the two absolute numbers is to the greatest number, or the radius of the circle: so that, however, of the said two secants, the less will have to the radius a less proportion than the proposed difference has to the first of all, but the greater will have a greater proportion, and so also will the mean proportional between the said secants have a greater proportion.

Thus if BC, CD be equal, also bd the logarithm of AB, and cd the logarithm of AC; then the proportion of bc to cd will be greater than the proportion of AG to AD, but less than that of AF to AD, and also less than that of the mean proportional between AF and AG to AD.



Corol. 1. The same obtains also when the two terms differ, not only by the unit of the small element, but by another unit which may be ten fold, a hundred fold, or a thousand fold of that.

Corol. 2. Hence the differences will be obtained sufficiently exact, especially when the absolute numbers are pretty large, by taking the arithmetical mean between two small secants, or (if you will be at the labour) by taking the geometrical mean between two larger secants, and then by continually adding the differences, the logarithms will be produced.

Corol. 3. Precept. Divide the radius by each term of the assigned proportion, and the arithmetical mean (or still nearer the geometrical mean) between the quotients will be the required increment, which being added to the logarithm of the greater term, will give the logarithm of the less term.

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EXAMPLE.

EXAMPLE.

Let there be given the logarithm of 700, viz. 35667.4948, to find the logarithm to 699.
Here radius divided by 700 gives 1428571, &c.
and divided by 699 gives 1430672, &c.
the arithmetic mean is 142.962
which added to 35667.4948

gives the logarithm to 699 35810.4568

Corol. 4. Precept for the logarithms of sine.

The increment between the logarithms of two fines is thus found: find the geometrical mean between the cosecants, and divide it by the difference of the fines, the quotient will be the difference of the logarithms.

EXAMPLE.

o 1' fine 2909 cosec. 343774682
o 2 fine 5818 cosec. 171887319

diff. 2909 geom. mean 2428 nearly.

The quotient 80000 exceeds the required increment of the logarithms, because the secants are here too large.

Appendix. Nearly in the same manner it may be shown, that the second differences are in the duplicate proportion of the first, and the third in the duplicate of the second. Thus, for instance, in the beginning of the logarithms, the first difference is 100.00000, viz. equal to the difference of the numbers 100000.00000 and 99900.00000; the second, or difference of the differences, 10000; the third 20. Again, after arriving at the number 50000.00000, the logarithms have for a difference 200.00000, which is to the first difference as the number 100000.00000 to 50000.00000; but the second difference is 40000, in which 10000 is contained four times; and the third 248, in which 20 is contained sixteen times. But since, in treating of new matters, we labour under the want of proper words, wherefore, lest we should become too obscure, the demonstration is omitted untried.

29. Prop. No number expresses exactly the measure of the proportion between two of the 1000 numbers constituted by the foregoing method.

30. Prop. If the measures of all proportions be expressed by numbers or logarithms; all proportions will not have assigned to them their due portion of measure, to the utmost accuracy.

31. Prop. If to the number 1000, the greatest of the chiliad, be referred others that are greater than it, and the logarithm of 1000 be made 0, the logarithms belonging to those greater numbers will be negative.

This concludes the first or scientific part of the work; the principles of which Kepler applies, in the second part, to the actual construction of the first 1000 logarithms, which is pretty minutely described. This part is intitled *A very compendious method of constructing the Chiliad of Logarithms*: and it is not improperly so called, the method being very concise and easy. The fundamental principles are briefly these: That at the beginning of the logarithms, their increments or differences are equal to those of the natural numbers: that the natural numbers may be considered as the decreasing cosines of increasing arcs: and that the secants of those arcs at the beginning have the same differences as the cosines, and therefore the same differences as the logarithms. Then, since the secants are the reciprocals of the cosines, by these principles and the third corol. to the twenty-eighth proposition, he establishes the fol-

lowing method of constituting the 100 first or smallest logarithms to the 100 largest numbers, 1000, 999, 998, 997, &c. to 900, viz. Divide the radius 1000, increased with seven ciphers, by each of these numbers separately, disposing the quotients in a table, and they will be the secants of those arcs which have the divisors for their cosines; continuing the division to the 8th figure, as it is in that place only that the arithmetical and geometrical means differ. Then, by adding successively the arithmetical means between every two successive secants, the sums will be the series of logarithms. Or, by adding continually every two secants, the successive sums will be the series of the double logarithms.

Besides these 100 logarithms thus constructed, he constitutes two others by continual bisection or extractions of the square root, after the manner described in the second postulate. And first he finds the logarithm which measures the proportion between 100000.00 and 97656.25, which latter term is the third proportional to 1024 and 1000, each with two cyphers; and this is effected by means of twenty-four continual extractions of the square root, determining the greatest term of each of twenty-four classes of mean proportionals; then the difference between the greatest of these means and the first or whole number 1000, with ciphers, being as often doubled, there arises 2371.6526 for the logarithm sought, which made negative is the logarithm of 1024. Secondly, the like process is repeated for the proportion between the numbers 1000 and 500, from which arises 69314.7193 for the logarithm of 500; which he also calls the logarithm of duplication, being the measure of the proportion of 2 to 1.

Then from the foregoing he derives all the other logarithms in the chiliad, beginning with those of the prime numbers 1, 2, 3, 5, 7, &c. in the first 100. And first, since 1024, 512, 256, 128, 64, 32, 16, 8, 4, 2, 1, are all in the continued proportion of 1000 to 500, therefore the proportion of 1024 to 1 is decuple of the proportion of 1000 to 500, and consequently the logarithm of 1 would be decuple of the logarithm of 500, if 0 were taken as the logarithm of 1024; but since the logarithm of 1024 is applied negatively, the logarithm of 1 must be diminished by as much: diminishing therefore 10 times the logarithm of 500, which is 693147.1928, by 2371.6526, the remainder 690775.5422 is the logarithm of 1, or of 100.00 what is set down in the table.

And because 1, 10, 100, Nos. Logarithms.
1000, are continued proportions, therefore the proportion of 1000 to 1 is triple of the proportion of 1000 to 100, and consequently 3 of the logarithm of 1 is to be put for the logarithm of 100, viz. 230258.5141, and this is also the logarithm of decuplication, or of the proportion of 10 to 1. And hence

Construc-
tion of
Logarithms

Construc-
tion of
Logarithms

hence multiplying this logarithm of 100 successively by 2, 3, 4, 5, 6, and 7, there arise the logarithms to the numbers in the decuple proportion, as under.

Also if the logarithm of duplication, or of the proportion of 2 to 1, be taken from the logarithm of 1, there will remain the logarithm of 2; and from the logarithm of 2 taking the logarithm of 10, there remains the logarithm of the proportion of 5 to 1; which taken from the logarithm of 1, there remains the logarithm of 5. See the margin.

For the logarithms of other prime numbers, he has recourse to those of some of the first or greatest century of numbers, before found, viz. of 999, 998, 997, &c. And first, taking 960, whose logarithm is 4082.2001; then by adding to this logarithm the logarithm of duplication, there will arise the several logarithms of all these numbers, which are in duplicate proportion continued from 960, namely 480, 240, 120, 60, 30, 15. Hence the logarithm of 30 taken from the logarithm of 10, leaves the logarithm of the proportion of 3 to 1; which taken from the logarithm of 1, leaves the logarithm of 3, viz. 5809.143106. And the double of this diminished by the logarithm of 1, gives 4710.530790 for the logarithm of 9.

Next, from the logarithm of 990, or $9 \times 10 \times 11$, which is 1005.0331, he finds the logarithm of 11; namely, subtract the sum of the logarithms of 9 and 10 from the sum of the logarithm of 990, and double the logarithm of 1, there remains 450986.0106 the logarithm of 11.

Again, from the logarithm of 980, or $2 \times 10 \times 7 \times 7$, which is 2020.2711, he finds 496184.5228 for the logarithm of 7.

And from 5129.3303 the logarithm of 950 or $5 \times 10 \times 19$, he finds 396331.6392 for the logarithm of 19.

In like manner the logarithm to 998 or $4 \times 13 \times 19$, gives the logarithm of 13; to 969 or $3 \times 17 \times 19$, gives the logarithm of 17; to 986 or $2 \times 17 \times 29$, gives the logarithm of 29; to 966 or $6 \times 7 \times 23$, gives the logarithm of 23; to 930 or $3 \times 10 \times 31$, gives the logarithm of 31.

And so on for all the primes below 100, and for many of the primes in the other centuries up to 900. After which he directs to find the logarithms of all numbers composed of these, by the proper addition and subtraction of their logarithms, namely, in finding the logarithm of the product of two numbers, from the sum of the logarithms of the two factors take the logarithm of 1, the remainder is the logarithm of the product. In this way he shows, that the logarithms of all numbers under 500 may be derived, except those of the following 36 numbers, namely 127, 149, 167, 173, 179, 211, 223, 251, 257, 263, 269, 271, 277, 281, 283, 293, 337, 347, 349, 353, 359, 367, 373, 379, 383, 389, 397, 401, 409, 419, 421, 431, 433, 439, 443, 449. Also, besides the composite numbers between 500 and 900, made up of the products of some numbers whose logarithms have been before determined, there will be 59 primes not composed of them; which with the 36 above mentioned make 95 num-

bers in all not composed of the products of any before them, and the logarithms of which he directs to be derived in this manner; namely, by considering the differences of the logarithms of the numbers interperled among them; then by that method by which were constituted the differences of the logarithms of the smallest 100 numbers in a continued series, we are to proceed here in the discontinued series, that is, by prop. 28th, coroll. 3d, and especially by the appendix to it, if it be rightly used, from whence those differences will be very easily supplied.

§ 3. Mr Briggs's Method.

THE methods principally made use of by this gentleman were published in Napier's posthumous work. Having supposed 0 to be the logarithm of 1, and 1 with any number of ciphers annexed, suppose 10 to be the logarithm of 10, this number is to be divided ten times by 5, which in a logarithmic number is equivalent to the extraction of the root of the fifth power; by which means he obtains the following numbers, viz. 2 with nine ciphers to it; 4 with eight ciphers; 8 with seven ciphers; 16 with six ciphers; 32 with five ciphers; 64 with four; 128000, 25600, 5120, and 1024. Dividing this last logarithm ten times by 2, we have a geometrical series of ten numbers; the first of which is 512, and the last 1. Thus 20 logarithms are obtained: but the labour of finding the numbers belonging to them is so excessive, that it is surprising how it could be undergone by any body. To obtain those corresponding to the first ten logarithms, the fifth root must be extracted ten times, and the square root as often, to obtain the numbers corresponding to the others. The power from which these extractions is made, must originally be 1, with a number of ciphers annexed. Other logarithms might be formed from these by adding them, and multiplying their corresponding numbers; but as this method, besides its excessive labour, would produce only an *antilogarithmic* canon like that of Mr Dodson already mentioned, other more easy and proper methods were thought of.

The next was by finding continually geometrical means, first between 10 and 1, and then between 10 and that mean, and so on, taking the arithmetical means between their corresponding logarithms. The operation is also facilitated by various properties of numbers and their logarithms, as that the products and quotients of numbers correspond to the sums and differences of their logarithms; that the powers and roots of numbers answer to the products and quotients of the logarithms by the index of the power or root. Thus having the logarithm of 2, we can have those of 4, 16, 256, &c. by multiplying the logarithms by 2, and squaring the numbers to as great an extent in that series as we please. If we have also that of 3, we can not only have those of 9, 81, 8561, &c. but of 6, 18, 27, and all possible products of the powers of 2 and 3 into one another, or into the numbers themselves. The following property may also be of use, viz. that if the logarithms of any two numbers are given, and each number be raised to the power denoted by the index of the other, the products will be equal. Thus,

Log.	0	1	2	3	4	5	6
Nat. numb.	1	2	4	8	16	32	64

Let the two numbers be 4 and 16; it is plain, that if

Confir-
mation of
Logarithms

we raise 4 to the fourth power and 16 to the square, the products will be the same; for $16 \times 16 = 256$, and $4 \times 4 = 16$; $16 \times 4 = 64$; and $64 \times 4 = 256$.

Another method mentioned by Mr Briggs depends upon this property, that the logarithm of any number in this scale is 1 less than the number of places or figures contained in that power of that number whose exponent is the logarithm of 10, at least as to integral numbers; for Mr Briggs has shown that they really differ by a fraction. To this Mr Hutton adds the following; viz. that of any two numbers, as the greater is to the less, so is the velocity of the increment or decrement of the logarithms at the greater; "that is (says he), in our modern notation, as $X : Y :: y : x$; where x and y are the fluxions of X and Y .

In the treatise written upon the construction of logarithms by Mr Briggs himself, he observes, that they may be constructed chiefly by the two methods already mentioned, concerning which he premises several lemmata concerning the powers of numbers and their indices, and how many places of figures are in the products of numbers. He observes, that these products will consist of as many figures as there are in both factors, unless the first figures in each factor be expressed in one figure only, which sometimes happens, and then there will commonly be one figure less in the product than in the two factors. He observes also, that if in any series of geometricals, we take two terms, and raise one to the power denoted by the index of the other, or any number raised to the power denoted by the logarithm of the other, the product will be equal to this latter number raised to the power denominated by the logarithm of the former. Hence, if one of the numbers be 10, whose logarithm is 1 with any number of cyphers, then any number raised to the power whose index is the logarithm of that number, that is, the logarithm of any number in this scale where 1 is the logarithm of 10, is the index of that power of 10, which is equal to the given number. But the index of any integral power of 10 is one less than the number of places of figures it contains. Thus the square of 10, or 100, contains three places of figures, which is more by one, than 2 the index of the power; 1000, the cube of 10 contains four places, which is one more than the index, 3, of the power. Hence as the number of places of the powers of 10 are always exactly one more than the indices of those powers, it follows that the places of figures in the powers of any other number which is no integral power of 10, will not always be exactly one less in number than the indices of the powers. From these two properties is deduced the following rule for finding the logarithms of many prime numbers.

Find the 10th, 100th, 1000th, or any other power of a number, suppose 2, with the number of places of figures in it, then that number of figures shall always exceed the logarithm of 2, although the excess will be constantly less than 1; whence by proceeding to very high powers we will at last be able to obtain the logarithm of the number to great exactness.

Thus, the logarithm of 2, found by other methods, is known to be 30102999566389, &c. The tenth power of 2 is 1024; which containing four places of figures, gives 4 for the logarithm of 2, which exceeds it, though not quite by 1. The 20th power of 2, consisting of the 10th power multiplied into itself, by

its number of places ought to give the logarithm of 4; and according to the rule already laid down, should contain eight places of figures: but by reason of the cipher which stands in the second place, it is easy to see that it must contain only seven; which therefore gives seven for the logarithm of four. The logarithm of 16 is then expressed by the number of places of figures in the product of the 20th power of 2 into itself; and is therefore denominated by 13. That of 256 is denoted by the 80th power of 2, containing 25 places of figures. The logarithm of 2, therefore, having been already expressed by the 10th power of 2, will be again expressed by the 100th power. Adding, therefore, the number of places contained in the 80th power, viz. 25 to 7, the number of places contained in the 20th, we have 32 for the next expression of that logarithm. On account of the cipher which stands in the second place of one of the factors, however, we must deduct one from the number; and thus we have 31 for the logarithm of 2, which is a considerable approximation. Proceeding in this manner, at the 100th power of 2, we have 302 for the logarithm of 2; at the 10,000th power we have 3011; at the 100,000th power, 30103; at the 1,000,000th, we have 301030; and at the 10,000,000th power, we obtain 3010300; which is as exact as is commonly expressed in the tables of logarithms; but by proceeding in the same manner we may have it to any degree of exactness we please. Thus, at the 100,000,000th power, we have 30103000; and at the 1,000,000,000th, the logarithm is 301029996, true to eight places of figures.

The only difficulty in this method is to find the number of places of figures in the different powers without multiplying them; but this may be determined by only multiplying the first five; or even the first three of the products will be sufficient to determine this; and the logarithms may thus be found with very great facility.

When the logarithms, however, are required to a very great degree of exactness, our author thinks that the method of mean proportionals is most eligible. This consists in finding a great number of mean proportionals betwixt 1 and the number proposed; that is, first extracting the square root of the number itself, then extracting the root of that root, &c. until the last root shall exceed 1 only by a very small decimal. Finding then the logarithm of this number by methods hereafter to be described, he multiplies it by the index of the power of 2, denoted by the number of extractions of the square root; and the result is the required logarithm of the given number. In this method, the number of decimal places contained in the last root ought to be double the number of true places required in the logarithm itself, and the first half of them ought to be cyphers, the integer being 1. To find out the first small number and its logarithm, our author begins with 10 and its logarithm 1; continually extracting the root of the former, and bisecting the latter, till he comes to the 54th root, and then finds, that at the 53d and 54th roots both natural numbers and logarithms bear the same proportion to each other, viz. that of 2 to 1. Thus,

Numbers.

53 | 1.00000,00000,00000,25563,82956,40064,70
54 | 1.00000,00000,00000,12781,91493,120033,35

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Lo-

Confir-
mation of
Logarithms

Construc-
tion of
Logarithms

Logarithms.

5310.00000, 00000, 00000, 11202, 23024, 62515, 65404
5412.00000, 00000, 00000, 05551, 11512, 3217, 81702

Construc-
tion of
Logarithms

If now by continual extraction and bisection we find any other small number, it will then be, as 12781, &c. is to 5551, &c. so is that other small decimal to the correspondent significant figures of its logarithm. To avoid, however, the excessive labour of such long multiplications and divisions, he reduces this ratio to another, the antecedent of which is 1. Thus, as 12781, &c. is to 5551, &c. so is 1 with as many ciphers annexed as precede the logarithms above mentioned, viz. 15, with another unit annexed to a 4th number, which will be the significant figures of the logarithm of the third term. The proportions then will be 12781 &c. : 5551 &c. :: 1.00000, 00000, 00000, 1 : 43429, 9445190351804; this last number, with 17 ciphers prefixed, being the logarithm of the one immediately preceding it. Having therefore found by continual extraction any such small decimal as the above, multiply it by 4342, &c. and the product will be the corresponding logarithm of the last root.

Still, as the labour of so many extractions must be intolerably tedious, it became necessary to fall upon some contrivances to shorten such operations; and of these the following is an example.

Let the number of which we seek the logarithm be involved to such an height that the index of the power may be one, with either one or more ciphers next to it. Divide this power then by 1 with as many ciphers annexed as the power has significant figures after the first; or, supposing all the figures after the first to be decimals, the roots are extracted continually from this power, till the decimal becomes sufficiently small, as when the first 15 places are ciphers; then, multiplying the decimal by 43429, &c. we have the logarithm of this last root; which logarithm, multiplied by the like power of the number 2, gives the logarithm of the first number of which the extraction was begun. To this logarithm if we prefix 1, 2, 3, &c. according as this number was found by dividing the power by 10, 100, 1000, &c. and lastly, dividing the result by the index of that power, the quotient will be the required logarithm of the given prime number.

Thus to find by this method the logarithm of 2. Raise it first to the 10th power, which is 1024; then cutting off for decimals the last three figures, we continually extract the square root from 1,024 forty-seven times, which gives

1.00000, 00000, 00000, 16851, 60579, 53949, 77; the decimal part of which multiplied by 43429, &c. gives 0.00000, 00000, 00000, 07313, 55936, 90623, 9368 for its logarithm, which being continually doubled 47 times, or multiplied at once by the 47th power of 2, viz. 140737488355328, gives for the logarithm of the number 10240.01029, 99566, 39811, 95265, 27744; true to 17 or 18 places of decimals; then prefixing to this

number 3, because the division was made by 1000 (for cutting off the three places of decimals is the same as dividing by 1000), we have for the logarithm of 1024, 3.010299566, &c. as above. Lastly, dividing by 10, because 1024 is the 10th power of 2, we have the logarithm of 2 itself; viz. 0.30102, &c.

The involving of any number to a very high power is by no means a matter of such difficulty as might at first sight be imagined. A number multiplied by itself produces the *square*; the square multiplied by itself produces the *biquadrate*; the biquadrate multiplied by itself gives the eighth power, and the eighth power multiplied by the square produces the tenth. The tenth power multiplied by itself gives the 20th, and the 20th multiplied by itself the 40th. The eighth power divided by the original number gives the seventh; and the 40th power multiplied by the seventh gives the 47th power required.

The *differential* method of constructing logarithms was likewise invented by our author, and greatly shortens the labour of finding the mean proportionals. Mr Briggs, in the course of his calculations, had observed, that these proportionals, found by continual extraction of roots, gradually approach nearer and nearer to the halves of the preceding root; and that as many significant figures as there are cyphers before them, agree exactly in this proportion. Subtracting therefore each of these decimal parts, which he called A, or the first differences, from half the next preceding one, and by comparing together the remainders or second differences, called B, he found that the succeeding were always nearly equal to $\frac{1}{4}$ of the next preceding ones; then taking the difference between each second difference and $\frac{1}{4}$ of the preceding one, he found that these third differences, called C, were nearly in the continual ratio of 8 to 1; again taking the difference between each C and $\frac{1}{4}$ of the next preceding, he found that these fourth differences, called D, were nearly in the continual ratio of 16 to 1; and so on, the 5th (E), 6th (F), &c. differences, being nearly in the continual ratio of 32 to 1, of 64 to 1, &c.: these plain observations being made, they very naturally and clearly suggested to him the notion and method of constructing all the remaining numbers from the differences of a few of the first, found by extracting the roots in the usual way. This will evidently appear from the annexed specimen of a few of the first numbers in the last example for finding the logarithm of 6; where after the 9th number the rest are supposed to be constructed from the preceding differences of each, as here shown in the 10th and 11th. And it is evident that, in proceeding, the trouble will become always less and less; the differences gradually vanishing, till at last only the first differences remain. And that generally each less difference is shorter than the next greater, by as many places as there are cyphers at the beginning of the decimal in the number to be generated from the differences.

	1,00776,96	
1	1,00387,72833,36962,45633,84655,1	A
2	1,00193,67661,36946,61673,87022,9	A
3	1,00096,79146,39099,01728,89027,2	A
4	1,00048,38402,68846,62985,49253,5	A
5	1,00024,18908,78824,68533,80872,7	A
	24,19201,34423,31492,74626,7	A
	292,55598,62928,93754,0	B
6	1,00012,09381,12639,71345,94391,4	A
	12,09454,39412,34281,90436,3	A
	73,13015,52082,46516,9	B
	73,13899,65732,23438,5	B
	88,44499,76921,5	C
7	1,00006,04672,35055,30968,01600,5	A
	6,04690,63188,56729,71959,7	A
	18,28143,25761,70359,2	B
	18,28253,80205,61629,2	B
	110,54443,91270,0	C
	110,55613,72115,2	C
	1169,80845,2	D
8	1,00003,02331,16050,56775,96479,4	A
	3,02336,17527,65484,00800,2	A
	4,57021,99708,04320,8	B
	4,57035,81440,42589,8	B
	13,81732,82860,0	C
	13,81805,48908,5	C
	73,10639,7	D
	73,11302,8	D
	663,1	E

9	1,00001,51164,65999,05672,95048,8	A
	1,51165,80252,82887,98239,7	A
	1,14253,77215,03190,9	B
	Hitherto the 1,14255,49927,01080,2	B
	smaller differences 1,72711,97889,3	C
	are found by sub- 1,72716,54783,6	C
	tracting the larger from 4,56894,3	D
	the parts of the like pre- 4,56915,0	D
	ceding ones. 20,7	E
	20,7	E
	Here the greater differences 65	E
	remain after subtracting 28555,89	E
	the smaller from the parts 28555,24	D
	of the difference of 21588,99736,16	C
	the next preceding 21588,71180,92	C
	number. 28563,44303,75797,72	B
	28563,22715,04616,80	B
	75582,32999,52836,47524,40	A
10	1,00000,75582,04436,30121,42907,60	A
	1784,70	E
	1784,60	D
	2698,58897,62	C
	2698,57112,94	C
	7140,80678,76154,20	B
	7140,77980,19041,26	B
	3779,102218,15060,71453,80	A
11	1,00000,37790,95077,37080,52412,54	A

He then concludes this chapter with an ingenious, but not obvious, method of finding the differences B, C, D, E, &c. belonging to any number, as suppose the 9th, from that number itself, independent of any of the preceding 8th, 7th, 6th, 5th, &c.;

and it is this: Raise the decimal A to the 2d, 3d, 4th, 5th, &c. powers; then will the 2d (B), 3d (C), 4th (D), &c. differences be as here below, viz.

$$\begin{aligned}
 B &= \frac{1}{2}A^2, \\
 C &= \frac{1}{6}A^3 + \frac{1}{24}A^4, \\
 D &= \frac{1}{24}A^4 + \frac{1}{72}A^5 + \frac{1}{720}A^6 + \frac{1}{5040}A^7 + \\
 E &= \frac{1}{720}A^5 + \frac{1}{2520}A^6 + \frac{1}{15120}A^7 + \frac{1}{60480}A^8 + \frac{1}{271584}A^9 + \frac{1}{1105920}A^{10}, \\
 F &= \frac{1}{15120}A^6 + \frac{1}{86400}A^7 + \frac{1}{291600}A^8 + \frac{1}{834000}A^9 + \frac{1}{1953120}A^{10}, \\
 G &= \frac{1}{86400}A^7 + \frac{1}{252000}A^8 + \frac{1}{1147500}A^9 + \frac{1}{6837216}A^{10}, \\
 H &= \frac{1}{252000}A^8 + \frac{1}{1510176}A^9 + \frac{1}{7068450}A^{10}, \\
 I &= \frac{1}{1510176}A^9 + \frac{1}{5490240}A^{10} + \frac{1}{2558465}A^{11}, \\
 K &= \frac{1}{5490240}A^{10} + \frac{1}{2805527}A^{11}, \\
 &\text{&c.}
 \end{aligned}$$

Thus in the 9th number of the foregoing example, omitting the ciphers at the beginning of the decimals, we have

$$\begin{aligned}
 A &= 1,51164,65999,05672,95048,8 \\
 A^2 &= 2,28507,54433,06381,6726 \\
 A^3 &= 3,45422,65239,48546,2 \\
 A^4 &= 5,22156,97802,288 \\
 A^5 &= 7,89316,8205 \\
 A^6 &= 11,93168,1 \\
 &\text{&c.}
 \end{aligned}$$

Consequently

$$\begin{aligned}
 A^{\frac{1}{2}} &= 1,14253,77215,03190,8363 = B \\
 \frac{1}{2}A^{\frac{1}{2}} &= 1,72711,32619,74273 \\
 \frac{1}{6}A^{\frac{1}{2}} &= 65269,62225 \\
 \frac{1}{24}A^{\frac{1}{2}} &= 1,72711,97889,36498 = C \\
 \frac{1}{720}A^{\frac{1}{2}} &= 4,56887,35577 \\
 \frac{1}{2520}A^{\frac{1}{2}} &= 6,90652 \\
 \frac{1}{15120}A^{\frac{1}{2}} &= 5 \\
 \frac{1}{86400}A^{\frac{1}{2}} &= 4,56894,26234 = D
 \end{aligned}$$

$$\begin{aligned}
 2^{\frac{1}{2}}A^{\frac{1}{2}} &= 20,71957 \\
 7A^{\frac{1}{2}} &= 83 \\
 2^{\frac{1}{2}}A^{\frac{1}{2}} + 7A^{\frac{1}{2}} &= 20,72040 = E
 \end{aligned}$$

which agree with the like differences in the foregoing specimen.

§ 4. Of Curves related to Logarithms.

SEVERAL other ingenious methods and improvements are laid down by our author in his treatise upon this subject; but as all these were attended with great labour, mathematicians still continued their efforts to facilitate the work; and it was soon perceived that some curves had properties analogous to logarithms. Edmund Gunter, it has been said, first gave the idea of a curve, whose abscissas are in arithmetical progression, while the corresponding ordinates are in geometrical progression, or whose abscissas are the logarithms of their ordinates; but it is not noticed in any part of his writings. The same curve was afterwards considered

Construc-
tion of
Logarithms

Construc-
tion of
Logarithms

considered by others, and named the *logarithmic* or *logarithmic curve* by Huygens in his *Disquisitione de Causa Gravitationis*, where he enumerates all the principal properties of this curve, showing its analogy to logarithms. Many other learned men have also treated of its properties; particularly Le Seur and Jacquier in their comment on Newton's Principia; Dr John Kiell in the elegant little tract on logarithms subjoined to his edition of Euclid's Elements; and Francis Maferes, Esq; curi-ator baron of the exchequer, in his ingenious treatise on Trigonometry; in which books the doctrine of logarithms is copiously and learnedly treated, and their analogy to the logarithmic curve, &c. fully displayed. It is indeed rather extraordinary that this curve was not sooner announced to the public; since it results immediately from Baron Napier's manner of conceiving the generation of logarithms, by only supposing the lines which represent the natural numbers to be placed at right angles to that upon which the logarithms are taken. This curve greatly facilitates the conception of logarithms to the imagination, and affords an almost intuitive proof of the very important property of their fluxions, or very small increments, viz. that the fluxion of the number is to the fluxion of the logarithm, as the number is to the subtangent; as also of this property, that, if three numbers be taken very nearly equal, so that their ratios to each other may differ but a little from a ratio of equality; as for example, the 3 numbers 10,000,000, 10,000,001, 10,000,002, their differences will be very nearly proportional to the logarithms of the ratios of those numbers to each other: all which follows from the logarithmic arcs being very little different from their chords, when they are taken very small. And the constant subtangent of this curve is what was afterwards by Cotes called the *modulus* of the system of logarithms: and since, by the former of the two properties above mentioned, this subtangent is a fourth proportional to the fluxion of the number, the fluxion of the logarithm, and the number, this property afforded occasion to Mr Baron Maferes to give the following definition of the *modulus*, which is the same in effect as Cotes's, but more clearly expressed; namely, that it is the limit of the magnitude of a fourth proportional to these three quantities, viz. the difference of any two natural numbers that are very nearly equal to each other, either of the said numbers and the logarithm or measure of the ratio they have to each other. Or we may define the *modulus* to be the natural number at that part of the system of logarithms, where the fluxion of the number is equal to the fluxion of the logarithm, or where the numbers and logarithms have equal differences. And hence it follows, that the logarithms of equal numbers or of equal ratios, in different systems, are to one another as the *moduli* of those systems. Moreover, the ratio whose measure or logarithm is equal to the *modulus*, and thence by Cotes called the *ratio modularis*, is by calculation found to be the ratio of 2.718281828459, &c. to 1, or of 1 to .367879441171, &c.: the calculation of which number may be seen at full length in Mr Baron Maferes's treatise on the Principles of Life-annuities, p. 274 and 275.

The hyperbolic curve also afforded another source for developing and illustrating the properties and construction of logarithms. For the hyperbolic areas ly-

ing between the curve and one asymptote, when they are bounded by ordinates parallel to the other asymptote, are analogous to the logarithms of their abscissas or parts of the asymptote. And so also are the hyperbolic sectors; any sector bounded by an arc of the hyperbola and two radii being equal to the quadrilateral space bounded by the same arc, the two ordinates to either asymptote from the extremities of the arc and the part of the asymptote intercepted between them. And although Napier's logarithms are commonly said to be the same as hyperbolic logarithms, it is not to be understood that hyperbolas exhibit Napier's logarithms only, but indeed all other possible systems of logarithms whatever. For, like as the right-angled hyperbola, the side of whose square is inscribed at the vertex is 1, gives us Napier's logarithms; so any other system of logarithms is expressed by the hyperbola whose asymptotes form a certain oblique angle, the side of the rhombus inscribed at the vertex of the hyperbola in this case also being still 1, the same as the side of the square in the right-angled hyperbola. But the areas of the square and rhombus, and consequently the logarithms of any one and the same number or ratio, will differ according to the sine of the angle of the asymptotes. And the area of the square or rhombus, or any inscribed parallelogram, is also the same thing as what was by Cotes called the *modulus* of the system of logarithms; which modulus will therefore be expressed by the numerical measure of the sine of the angle formed by the asymptotes, to the radius 1; as that is the same with the number expressing the area of the said square or rhombus, the side being 1: which is another definition of the modulus to be added to those we before remarked above in treating of the logarithmic curve. And the evident reason of this is, that in the beginning of the generation of these areas from the vertex of the hyperbola, the nascent increment of the abscissa drawn into the altitude 1, is to the increment of the area, as radius is to the sine of the angle of the ordinate and abscissa, or of the asymptotes; and at the beginning of the logarithms, the nascent increment of the natural numbers is to the increment of the logarithms as 1 is to the modulus of the system. Hence we easily discover, that the angle formed by the asymptotes of the hyperbola, exhibiting Briggs's System of Logarithms, will be $25^{\circ} 44' 25''$; this being the angle whose sine is 0.4342944819 , &c. the modulus of this system.

Or indeed any one hyperbola, as has been remarked by Mr Baron Maferes, will express all possible systems of logarithms whatever; namely, if the square or rhombus inscribed at the vertex, or, which is the same thing, any parallelogram inscribed between the asymptotes and the curve at any other point, be expounded by the modulus of the system; or, which is the same, by expounding the area, intercepted between two ordinates which are to each other in the ratio of 10 to 1 , by the logarithm of that ratio in the proposed system.

As to the first remarks on the analogy between logarithms and the hyperbolic spaces; it having been shown by Gregory St Vincent, in his *Quadratura Circuli et Sectorum Coni*, published at Antwerp in 1647, that if one asymptote be divided into parts in geometrical progression, and from the points of division or-

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Construc-
tion of
Logarithms

dinates be drawn parallel to the other asymptote, they will divide the space between the asymptote and curve into equal portions; from hence it was shown by Mercennus, that, by taking the continual sums of those parts, there would be obtained areas in arithmetical progression, adapted to abscissas in geometrical progression, and which therefore were analogous to a system of logarithms. And the same analogy was remarked and illustrated soon after by Huygens and many others, who show how to square the hyperbolic spaces by means of the logarithms. There are likewise many other geometrical figures which have properties analogous to logarithms; such as the equiangular spiral, the figures of the tangents and secants, &c.

§ 5. Mercator's Method.

THIS is purely arithmetical, and is founded upon the idea of logarithms already mentioned; viz. that they are the measures of ratios, and express the number of *ratiuncule* contained in any ratio into which it may be divided. Having shown then that these logarithms, or numbers of small ratios, or measures of ratios, may be all properly represented by numbers; and that of 1, or the ratio of equality, the logarithm or measure being always 0, the logarithm of 10, or the measure of the ratio of 10 to 1, is most conveniently represented by 1 with any number of ciphers; he then proceeds to show how the measures of all other ratios may be found from this last supposition. And he explains the principles by the two following examples.

First, to find the logarithm of 100·5, or to find how many *ratiuncule* are contained in the ratio of 100·5 to 1, the number of *ratiuncule* in the decuple ratio, or ratio of 10 to 1, being 10,000,000.

The given ratio 100·5 to 1 he first divides into its parts; namely, 100·5 to 100, 100 to 10, and 10 to 1; the last two of which being decuples, it follows that the characteristic will be 2, and it only remains to find how many parts of the next decuple belong to the first ratio of 100·5 to 100. Now if each term of this ratio be multiplied by itself, the products will be in the duplicate ratio of the first terms, or this last ratio will contain a double number of parts; and if these be multiplied by the first terms again, the ratio of the last products will contain three times the number of parts, and so on; the number of times of the first parts contained in the ratio of any like powers of the first terms, being always denoted by the exponent of the power. If therefore the first terms 100·5 and 100 be continually multiplied till the same powers of them have to each other a ratio whose measure is known; as suppose the decuple ratio 10 to 1, whose measure is 10,000,000: then the exponent of that power shows what multiple this measure 10,000,000 of the decuple ratio is of the required measure of the first ratio 100·5 to 100; and consequently dividing 10,000,000 by that exponent, the quotient is the measure of the ratio 100·5 to 100 sought. The operation for finding this he sets down as here follows; where the several multiplications are all performed in the contracted way by inverting the figures of the multiplier, and retaining only the first number of decimals in each product.

Nº 184.

Power.

Construc-
tion of
Logarithms

100·5000	-	-	-	1
5001	-	-	-	1
1005000				
5025				
1010025	-	-	-	2
5200101	-	-	-	2
1010025				
10100				
20				
5				
1020150	-	-	-	4
0510201	-	-	-	4
1020150				
20403				
102				
51				
1040706	-	-	-	8
6070401	-	-	-	8
1083068	-	-	-	16
8603801	-	-	-	16
1173035	-	-	-	32
5303711	-	-	-	32
1376011	-	-	-	64
1106731	-	-	-	64
1893406	-	-	-	128
6043981	-	-	-	128
3584985	-	-	-	256
5894853	-	-	-	256
12852116	-	-	-	512

This power being greater than the decuple of the like power of 100, which must always be 1 with ciphers, resume therefore the 256th power, and multiply it not by itself but by the next before it, viz. by the 128th, thus,

3584985	-	-	-	256
6043981	-	-	-	128
6787831	-	-	-	384
1106731	-	-	-	64
9340130	-	-	-	448
5303711	-	-	-	32
10956299	-	-	-	480

This power again exceeding the same power of 100 more than 10 times, he therefore draws the same power 448th not into the 32d but the next preceding, thus,

9340130	-	-	-	448
8603801	-	-	-	16
10115994	-	-	-	464

This being again too much, instead of the 16th draw it into the 8th or next preceding, thus,

9340130	-	-	-	448
6070401	-	-	-	8
9720329	-	-	-	456
0510201	-	-	-	4
9916193	-	-	-	460
5200101	-	-	-	2
10015603	-	-	-	462

Which

Construc-
tion of
Logarithms

Construc-
tion of
Logarithms

Which power again exceeds the limit: therefore

draw the 460th into the 1st, thus,	Power.
9916193	460
5001	1
9965774	461

Since therefore the 462d power of 1005 is greater, and the 461st power is less, than the decuple of the same power of 100; he finds that the ratio of 1005 to 100 is contained in the decuple more than 461 times, but less than 462 times. Again,

Since $\frac{460}{461}$ power is $\frac{9916193}{9965774}$ and the differences $\frac{461}{462}$ is $\frac{49581}{49829}$ nearly equal; therefore the proportional part which the exact power, or 1000000, exceeds the next less 9965774, will be easily and accurately found by the Golden Rule, thus:

The just power	10000000
and the next less	9965774
the difference	34226; then,

As 49829 the dif. between the next less and greater, : To 34226 the dif. between the next less and just, :: So is 10000 : to 6868, the decimal parts; and therefore the ratio of 1005 to 100, is 461.6868 times contained in the decuple or ratio of 10 to 1. Dividing now 1,0000000, the measure of the decuple ratio, by 461.6868, the quotient .00216597 is the measure of the ratio of 1005 to 100; which being added to 2, the measure of 100 to 1, the sum 2,00216597 is the measure of the ratio of 1005 to 1, that is, the log. of 1005 is 2,00216597.

In the same manner he next investigates the log. of 995, and finds it to be 1,99782307.

A few observations are then added, calculated to generalize the consideration of ratios, their magnitude and affections. It is here remarked, that he considers the magnitude of the ratio between two quantities as the same, whether the antecedent be the greater or the less of the two terms; so the magnitude of the ratio of 8 to 5 is the same as of 5 to 8; that is, by the magnitude of the ratio of either to the other is meant the number of *ratiunculae* between them, which will evidently be the same whether the greater or less term be the antecedent. And he farther remarks, that of different ratios, when we divide the greater term of each ratio by the less, that ratio is of the greater mass or magnitude which produces the greater quotient, *et vice versa*; although those quotients are not proportional to the masses or magnitudes of the ratios. But when he considers the ratio of a greater term to a less, or of a less to a greater, that is to say, the ratio of greater or less inequality, as abstracted from the magnitude of the ratio, he distinguishes it by the word *affection*, as much as to say greater or less affection, something in the manner of positive and negative quantities, or such as are affected with the signs + and — The remainder of this work he delivers in several propositions, as follows:

Prop. 1. In subtraction from each other two quantities of the same affection, to wit, both positive, or both negative; if the remainder be of the same affection with the two given, then is the quantity subtracted the less of the two, or expressed by the less number; but if the contrary, it is the greater.

Prop. 2. In any continued ratios, as $\frac{a}{a+b}$, $\frac{a+b}{a+2b}$

Vol. X. Part I.

$\frac{a+2b}{a+3b}$, &c. (by which is meant the ratios of a to $a+b$, $a+b$ to $a+2b$, $a+2b$ to $a+3b$, &c.) of equidifferent terms, the antecedent of each ratio being equal to the consequent of the next preceding one, and proceeding from less terms to greater; the measure of each ratio will be expressed by a greater quantity than that of the next following; and the same through all their orders of differences, namely, the 1st, 2d, 3d, &c. differences; but the contrary, when the terms of the ratios decrease from greater to less.

Prop. 3. In any continued ratios of equidifferent terms, if the 1st or least be a , the difference between the 1st and 2d b , and c , d , e , &c. the respective first term of their 2d, 3d, 4th, &c. differences; then shall the several quantities themselves be as in the annexed scheme; where each term is composed of the first term together with as many of the differences as it is distant from the first term, and to those differences joining, for coefficients, the numbers in the sloping or oblique lines contained in the annexed table of figurate numbers; in the same manner, he observes, as the same figurate numbers complete the powers raised from a binomial root, as had long before been taught by others. He also remarks, that this rule not only gives any one term, but also the sum of any number of successive terms from the beginning, making the 2d coefficient the 1st, the 3d the 2d, and so on; thus, the sum of the first 5 terms is $5a + 10b + 10c + 5d + e$.

1st term	-	a
2d	-	$a + b$
3d	-	$a + 2b + c$
4th	-	$a + 3b + 3c + d$
5th	-	$a + 4b + 6c + 4d + e$
&c.		&c.

1	1	1	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9
1	3	6	10	15	21	28	36	
1	4	10	20	35	56	84		
1	5	15	35	70	126			
1	6	21	56	126				
1	7	28	84					
1	8	36						
1	9							

In the 4th *prop.* it is shown, that if the terms decrease, proceeding from the greater to the less, the same theorems hold good, by only changing the sign of every other term, as below.

1st term	-	a
2d	-	$a - b$
3d	-	$a - 2b + c$
4th	-	$a - 3b + 3c - d$
5th	-	$a - 4b + 6c - 4d + e$
&c.		&c.

Prop. 6th and 7th. treat of the approximate multiplication and division of ratios, or, which is the same thing, the finding nearly any powers or any roots of a given fraction, in an easy manner. The theorem for raising

Con-
struction
of
Logarithms

raising any power, when reduced to a simpler form, is this, the m power of $\frac{a}{b}$, or $\frac{a}{b}$ is $\frac{s \mp md}{s \pm md}$ nearly, where s is $a + b$, and $d = a - b$, the sum and difference of the two numbers, and the upper or under signs take place according as $\frac{a}{b}$ is a proper or an improper fraction, that is, according as a is less or greater than b . And the theorem for extracting the m th root of $\frac{a}{b}$ is $\sqrt[m]{\frac{a}{b}}$ or $\frac{a}{b}$ is $\frac{ms \mp d}{ms \pm d}$ nearly; which latter rule is also the same as the former, as will be evident by substituting $\frac{1}{m}$ instead of m in the first theo-

rem. So that universally $\frac{a}{b}$ is $\frac{ms \mp md}{ms \pm md}$ nearly.

These theorems, however, are nearly true only in some certain cases, namely, when $\frac{a}{b}$ and $\frac{m}{n}$ do not differ

greatly from unity. And in the 7th *prop.* the author shows how to find nearly the error of the theorems.

In the 8th *prop.* it is shown, that the measures of ratios of equidifferent terms, are nearly reciprocally as the arithmetical means between the terms of each ratio. So of the ratios $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$, the mean between the terms of the first ratio is 1, of the 2d $\frac{3}{4}$, of the 3d $\frac{1}{2}$, and the measures of the ratios are nearly as $\frac{1}{1}, \frac{1}{\frac{3}{4}}, \frac{1}{\frac{1}{2}}$.

From this property he proceeds, in the 9th *prop.* to find the measure of any ratio less than $\frac{2}{1}$, which has an equal difference (1) of terms. In the two examples mentioned near the beginning, our author found the logarithm or measure of the ratio, of $\frac{2}{1}$, to be 21769, and that of $\frac{100}{1}$, to be 21659, and therefore the sum 43429 is the logarithm of $\frac{200}{1}$, or $\frac{2}{1} \times \frac{100}{1}$, or the logarithm of $\frac{200}{1}$ is nearer 43430, as found by other more accurate computations.

Now, to find the logarithm of $\frac{2}{1}$, having the same difference of terms (1) with the former; it will be, by *prop.* 8. as 100,5 (the mean between 101 and 100): 100 (the mean between 99,5 and 100,5): 43430: 43421,3 the logarithm of $\frac{2}{1}$, or the difference between the logarithms of 100 and 101. But the logarithm of 100 is 2; therefore the logarithm of 101 is 2,0043213.—Again, to find the logarithm of 102, we must first find the logarithm of $\frac{102}{101}$; the mean between its terms being 101,5, therefore as 101,5: 100: 43430: 42788 the logarithm of $\frac{102}{101}$, or the difference of the logarithms of 101 and 102. But the logarithm of 101 was found above to be 2,0043213; therefore the logarithm of 102 is 2,0086500.—So that dividing continually 868596 (the double of 434298 the logarithm of $\frac{200}{1}$, or $\frac{2}{1} \times \frac{100}{1}$) by each number of the series 201, 203, 205, 207, &c. then add 2

$$\frac{a}{b} = .001, \frac{ac}{bb} = .000000005, \frac{ac^2}{b^3} = .000000000000025, \frac{ac^3}{b^4} = .000000000000000125,$$

$$\&c.; \text{ therefore } \frac{a}{b-c} = \frac{a}{b} + \frac{ac}{bb} + \frac{ac^2}{b^3} + \frac{ac^3}{b^4}, \&c. \text{ is } .001000005000025000125,$$

$$\text{In like manner, if } c = 1.5, \text{ then } \frac{a}{b+c} \text{ will be } .001000015000225003375;$$

$$\text{and if } c = 2.5, \text{ then } \frac{a}{b+c} \text{ will be } .001000025000625015625;$$

Con-
struction
of
Logarithms

to the 1st quotient, to the sum add the 2d quotient, and so on, adding always the next quotient to the last sum, the several sums will be the respective logarithms of the numbers in this series, 101, 102, 103, 104, &c.

The next, or *prop.* 10th, shows that, of two pair of continued ratios, whose terms have equal differences, the difference of the measures of the first two ratios is to the difference of the measures of the other two, as the square of the common term in the two latter is to that in the former, nearly. Thus, in the four ratios $\frac{a}{a+b}, \frac{a+b}{a+2b}, \frac{a+2b}{a+3b}, \frac{a+3b}{a+4b}$, as the measure of $\frac{a+2b}{a+b}$ (the difference of the first two, or the quotient of the two fractions): the measure of $\frac{a+3b}{a+2b}$ (the difference of the last two, or the quotient of the two fractions): $\frac{a+2b}{a+b}^2$: $\frac{a+3b}{a+2b}^2$, nearly.

In *prop.* 11. the author shows that similar properties take place among two sets of ratios, consisting each of 3 or 4, &c. continued numbers.

Prop. 12. shows, that of the powers of numbers in arithmetical progression, the orders of differences which become equal, are the second differences in the squares, the 3d differences in the cubes, the 4th differences in the 4th powers, &c. And from hence it is shown, how to construct all those powers by the continual addition of their differences: As had been long before more fully explained by Briggs.

In the next, or 13th *prop.* our author explains his compendious method of raising the tables of logarithms, showing how to construct the logarithms by adding only, from the properties contained in the 8th, 9th, and 12th propositions. For this purpose he

makes use of the quantity $\frac{a}{b-c}$, which by division he

resolves into this infinite series $\frac{a}{b} + \frac{ac}{bb} + \frac{ac^2}{b^3} + \frac{ac^3}{b^4}$ &c. (in *infin.*) Putting then $a = 100$ the arithmetical mean between the terms of the ratio $\frac{200}{1}$, $b = 100000$, and c successively equal to 0,5, 1,5, 2,5, &c. that is $b-c$ may be respectively equal to 99999,5, 99998,5, 99997,5, &c. the corresponding means between the terms of the ratios $\frac{200}{99999}, \frac{200}{99998}, \frac{200}{99997}$, &c. it

is evident that $\frac{a}{b-c}$ will be the quotient of the 2d term divided by the 1st in the proportions mentioned in the 8th and 9th propositions; and when each of these quotients are found, it remains then only to multiply them by the constant 3d term 43429, or rather 43429,8, of the proportion, to produce the logarithms of the ratios $\frac{200}{99999}, \frac{200}{99998}, \frac{200}{99997}$, &c. till $\frac{200}{1}$; then adding these continually to 4 the logarithm of 10000 the least number, or subtracting them from 5 the logarithm of the highest term 100000, there will result the logarithms of all the absolute numbers from 10000 to 100000. Now when c is 0,5, then

Construc-
tion of
Logarithms

&c. But instead of constructing all the values of $\frac{a}{b-c}$ in the usual way of raising the powers, he directs them to be found by addition only, as in the last proposition. Having thus found all the values of $\frac{a}{b-c}$, the author then

shows, that they may be drawn into the constant logarithm 43429 by addition only, by the help of the annexed table of the first 9 products of it.

The author then distinguishes which of the logarithms it may be proper to find in this way, and which from their component parts. Of these the logarithms of all even numbers need not be thus computed, being composed from the number 2; which cuts off one half of the numbers: neither are those numbers to be computed which end in 5, because 5 is one of their factors; these last are $\frac{1}{5}$ of the numbers; and the two together $\frac{4}{5} + \frac{1}{5}$ make $\frac{1}{2}$ of the whole: and of the other $\frac{1}{2}$, the

1	43429
2	86858
3	130287
4	173716
5	217145
6	260574
7	304003
8	347432
9	390861

As 10048, the arithmetical mean between 10033 and 10063,
to 10018, the arithmetical mean between 10003 and 10033,
so 13006, the difference between the logarithms of 10003 and 10033,
to 12967, the difference between the logarithms of 10033 and 10063;

That is, 1st As $\left\{ \begin{array}{l} 10048 \\ 10078 \\ 10108 \end{array} \right\}$: 10018 : : 13006 : $\left\{ \begin{array}{l} 12967 \\ \&c. \end{array} \right\}$
Again, As $\left\{ \begin{array}{l} 10058 \\ 10088 \\ 10118 \end{array} \right\}$: 10028 : : 12992 : $\left\{ \begin{array}{l} 12953 \\ \&c. \end{array} \right\}$
And 3dly, As $\left\{ \begin{array}{l} 10068 \\ 10098 \\ \&c. \end{array} \right\}$: 10038 : : 12979 : $\left\{ \begin{array}{l} 12940 \\ \&c. \end{array} \right\}$

And with this our author concludes his compendium for constructing the tables of logarithms.

§ 6. Gregory's Method.

THIS is founded upon an analogy between a scale of logarithmic tangents and Wright's protraction of the nautical meridian line consisting of the sums of the secants. It is not known by whom this discovery was made; but, about 1645, it was published by Mr Henry Bond, who mentions this property in Norwood's Epitome of Navigation. The mathematical demonstration of it was first investigated by Mercator; who, with a view to make some advantage of his discovery, offered, in the Philosophical Transactions for June 4th 1666, to lay a wager with any one concerning it; but this proposal not being accepted, the demonstration was not published. Other mathematicians, however, soon found out the mystery; and in two years after, Dr Gregory published a demonstration, and from this and other similar properties he showed a method of computing the logarithmic sines and tangents by means of an infinite series. Several of these were invented by him, and the method of applying them laid down by himself and others; but Mr Hutton thinks that a shorter and better method than any they proposed

$\frac{1}{2}$ of them, or $\frac{1}{2}$ of the whole, are composed of 3; and hence $\frac{1}{2} + \frac{1}{2}$, or $\frac{1}{1}$ of the numbers, are made up of such as are composed of 2, 3, and 5. As to the other numbers which may be composed of 7, of 11, &c.; he recommends to find their logarithms in the general way, the same as if they were incomposites, as it is not worth while to separate them in so easy a mode of calculation. So that of the 90 chiliads of numbers from 10000 to 100000, only 24 chiliads are to be computed. Neither indeed are all of these to

be calculated from the foregoing series for $\frac{a}{b-c}$, but

only a few of them in that way, and the rest by the proportion in the 8th proposition. Thus, having computed the logarithms of 10003 and 10013, omitting 10023 as being divisible by 3, estimate the logarithms of 10033 and 10043, which are the 30th numbers from 10003 and 10013; and again, omitting 10053, a multiple of 3, find the logarithms of 10063 and 10073. Then by prop. 8.

might have been found by computing, by means of the series, only a few logarithms of small ratios, in which the terms of the series would have decreased by the powers of 10 or some greater number, the numerators of all the terms being unity, and their denominators the powers of 10 or some greater number, and then employing these few logarithms, so computed, to the finding of the logarithms of other and greater ratios by the easy operations of mere addition and subtraction. This might have been done for the logs. of the ratios of the first ten numbers, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11, to 1, in the following manner, communicated by Mr Baron Mafceus.—In the first place the logarithm of the ratio of 10 to 9, or of 1 to $\frac{9}{10}$, or of 1 to $1 - \frac{1}{10}$, is equal to the series $\frac{1}{10} + \frac{1}{2 \times 100} + \frac{1}{3 \times 1000} + \frac{1}{4 \times 10000} + \frac{1}{5 \times 100000} \&c.$ In like manner are easily found the logarithms of the ratios of 11 to 10; and then by the same series those of 121 to 120, and of 81 to 80, and of 2401 to 2400; in all which cases the series would converge still faster than in the two first cases. We may then proceed by mere addition and subtraction of logarithms, as follows.

$\text{Log. } \frac{1}{9} = \text{L. } \frac{1}{10} + \text{L. } \frac{1}{9}$	$\text{L. } \frac{1}{10} = \text{L. } \frac{1}{9}$	$\text{L. } \frac{8}{9} = \text{L. } \frac{8}{10} - \text{L. } \frac{2}{10}$
$\text{L. } \frac{1}{81} = 2\text{L. } \frac{1}{9}$	$\text{L. } \frac{1}{9} = 2\text{L. } \frac{1}{10}$	$\text{L. } \frac{7}{9} = \text{L. } \frac{7}{10}$
$\text{L. } \frac{1}{729} = \text{L. } \frac{1}{81} + \text{L. } \frac{8}{81}$	$\text{L. } \frac{1}{90} = \text{L. } \frac{1}{10} + \text{L. } \frac{1}{9}$	$\text{L. } \frac{2}{9} = \text{L. } \frac{2}{10}$
$\text{L. } \frac{1}{6561} = \text{L. } \frac{1}{729} - \text{L. } \frac{1}{1771}$	$\text{L. } \frac{1}{8} = 2\text{L. } \frac{1}{4}$	$\text{L. } \frac{1}{7} = \text{L. } \frac{1}{5} - \text{L. } \frac{1}{35}$

S 2

Having

Construc-
tion of
Logarithms

Construc-
tion of
Logarithms.

Having thus got the logarithm of the ratio of 2 to 1, or, in common language, the logarithm of 2, the logarithms of all sorts of even numbers may be derived

from those of the odd numbers which are their coefficients with 2 or its powers. We may then proceed as follows.

Construc-
tion of
Logarithms.

$$\begin{array}{l|l|l} \text{L. } 4 = 2\text{L. } 2, & \text{L. } 100 = 2\text{L. } 10, & \text{L. } 2401 = \text{L. } \frac{2401}{11} + \text{L. } 2400, \\ \text{L. } 10 = \text{L. } \frac{1}{2} + \text{L. } 4, & \text{L. } 8 = 3\text{L. } 2, & \text{L. } 7 = \frac{1}{2}\text{L. } 2401, \\ \text{L. } 9 = \text{L. } \frac{2}{3} + \text{L. } 4, & \text{L. } 24 = \text{L. } 8 + \text{L. } 3, & \text{L. } 11 = \text{L. } \frac{1}{2} + \text{L. } 9. \\ \text{L. } 3 = \frac{1}{2}\text{L. } 9, & \text{L. } 2400 = \text{L. } 100 + \text{L. } 24, & \text{L. } 6 = \text{L. } 2 + \text{L. } 3. \end{array}$$

Thus we have got the logarithms of 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11. And this is upon the whole, perhaps, the best method of computing logarithms that can be taken.—This method of computing logarithms is very nearly the same with that of Sir Isaac Newton in his second letter to Mr Oldenburg, dated October 1676.

§ 7. Construction of Logarithms by Fluxions.

From the definition and description of logarithms given by Napier, and of which we have already taken notice, it appears that the fluxion of his, or the hyperbolic logarithm of any number, is a fourth proportional to that number, its logarithm and unity; or, which is the same, that it is equal to the fluxion of the number divided by the number: For the description shows that $21 : 2a$ or $1 : 21$ is the fluxion of $21 : 2a$,

which therefore is $= \frac{21}{21}$; but $2a$ is also equal to the fluxion of the logarithm A , &c. by the description; therefore the fluxion of the logarithm is equal to $\frac{21}{21}$, the fluxion of the quantity divided by the quantity itself.

The same thing appears again at art. 2. of of that little piece in the appendix to his *Constructio Logarithmorum*, intitled *Habitudoines Logarithmorum et suorum naturalium numerorum invicem*; where he observes, that as any greater quantity is to a less, so is the velocity of the increment or decrement of the logarithms at the place of the less quantity to that at the greater. Now this velocity of the increment or decrement of the logarithms being the same thing as their fluxions, that proportion is this $x : a :: \text{flux. log. } a : \text{flux. log. } x$; hence if $a = 1$, as at the beginning of the table of numbers, where the fluxion of the logs. is the index or characteristic c , which is also one in Napier's or the hyperbolic logarithms, and 43429, &c. in Briggs's, the same proportion becomes $x : 1 :: c : \text{flux. log. } x$; but the constant fluxion of the numbers is also 1, and therefore that proportion is also this $x : 1 :: \frac{cx}{x} =$ the

fluxion of the logarithm of x : and in the hyperbolic logarithms, where c is $= 1$, it becomes $\frac{x}{x} =$ the fluxion of Napier's or the hyperbolic logarithm of x . This same property has also been noticed by many other

authors since Napier's time. And the same or a similar property is evidently true in all the systems of logarithms whatever, namely, that the modulus of the system is to any number as the fluxion of its logarithm is to the fluxion of the number.

Now from this property, by means of the doctrine of fluxions, are derived other ways for making logarithms, which have been illustrated by many writers on this branch; as Craig, Jo. Bernoulli, and almost all the writers on fluxions. And this method chiefly consists in expanding the reciprocal of the given quantity in an infinite series, then multiplying each term by the fluxion of the said quantity, and lastly taking the fluents of the terms; by which there arises an infinite series of terms for the logarithm sought. So, to find the logarithm of any number N , put any compound quantity for N , as suppose $\frac{n+x}{n}$; then the flux-

of the log. or $\frac{N}{N}$ being $\frac{x}{n+x} = \frac{x}{n} \frac{nx}{nn} + \frac{x^2}{n^3} - \frac{x^3}{n^4}$, &c.

the fluents give log. of N or log. of $\frac{n+x}{n} = \frac{x}{n} \frac{x^2}{2n^3} + \frac{x^3}{3n^4} - \frac{x^4}{4n^5}$, &c. And writing $-x$ for x gives log.

$\frac{n-x}{n} = -\frac{x}{n} \frac{x^2}{2n^3} - \frac{x^3}{3n^4} - \frac{x^4}{4n^5}$, &c. Also, because $\frac{n}{n-x} = 1 + \frac{n+x}{n}$, or log. $\frac{n}{n-x} = 0 + \log. \frac{n+x}{n}$, we

have log. $\frac{n}{n+x} = -\frac{x}{n} \frac{x^2}{2n^3} - \frac{x^3}{3n^4} + \frac{x^4}{4n^5}$, &c. and log. $\frac{n}{n-x} = +\frac{x}{n} \frac{x^2}{2n^3} + \frac{x^3}{3n^4} + \frac{x^4}{4n^5}$, &c.

And by adding and subtracting any of these series to or from one another, and multiplying or dividing their corresponding numbers, various other series for logarithms may be found, converging much quicker than these do.

In like manner, by assuming quantities otherwise compounded for the value of N , various other forms of logarithmic series may be found by the same means.

§ 8. Mr Long's Method.

THIS method was published in the 339th number of the Philosophical Transactions; and is performed by means of a small table containing eight classes of logarithms, as follows.

Lo.	Nat. Num.	Log.	Nat. Num.	Log.	Nat. Num.	Log.	Nat. Num.
99	7,943282347	,009	1,020939484	,00009	1,000207254	,0000009	1,000002072
98	6,30573445	8	1,018591388	8	1,000184224	8	1,000001842
97	5,011872336	7	1,016248694	7	1,000161194	7	1,000001611
96	3,981071706	6	1,013911386	6	1,000138165	6	1,000001381
95	3,162277665	5	1,011579454	5	1,000115136	5	1,000001151
94	2,511886432	4	1,009252886	4	1,000092106	4	1,000000921
93	1,995262315	3	1,006931669	3	1,000069080	3	1,000000690
92	1,584893193	2	1,004615794	2	1,000046053	2	1,000000460
91	1,258925412	1	1,002305238	1	1,000023026	1	1,000000230
90	1,230268771	,0009	1,002074475	,00009	1,000020724	,0000009	1,000000207
8	1,202264435	8	1,000184376	8	1,000018421	8	1,000000184
7	1,174897555	7	1,000161310	7	1,000016118	7	1,000000161
6	1,148153621	6	1,000138250	6	1,000013816	6	1,000000138
5	1,122018454	5	1,000115195	5	1,000011513	5	1,000000115
4	1,096478196	4	1,000092145	4	1,000009210	4	1,000000092
3	1,071519305	3	1,0000691015	3	1,000006908	3	1,000000069
2	1,047128548	2	1,0000460623	2	1,000004605	2	1,000000046
1	1,023292992	1	1,0000230285	1	1,000002302	1	1,000000023

Here, because the logarithms in each class are the continual multiples 1, 2, 3, &c. of the lowest, it is evident that the natural numbers are so many scales of geometrical proportionals, the lowest being the common ratio, or the ascending numbers are the 1, 2, 3, &c. powers of the lowest, as expressed by the figures 1, 2, 3, &c. of their corresponding logarithms. Also the last number in the first, second, third, &c. class, is the 10th, 100th, 1000th, &c. root of 10; and any number in any class is the 10th power of the corresponding number in the next following class.

To find the logarithm of any number, as suppose of 2000, by this table: Look in the first class for the number next less than the first figure 2, and it is 1,995262315, against which is 3 for the first figure of the logarithm sought. Again, dividing 2, the number proposed, by 1,995262315, the number found in the table, the quotient is 1,002374467; which being looked for in the second class of the table, and finding neither its equal nor a less, 0 is therefore to be taken for the second figure of the logarithm; and the same quotient 1,002374467 being looked for in the third class, the next less is there found to be 1,002305238, against which is 1 for the third figure of the logarithm; and dividing the quotient 1,002374467 by the said next less number 1,002305238, the new quotient is 1,000069700; which being sought in the fourth class gives 0, but sought in the fifth class gives 2, which are the fourth and fifth figures of the logarithm sought: again, dividing the last quotient by 1,000046053, the next less number in the table, the quotient is 1,000023015, which gives 9 in the 6th class for the 6th figure of the logarithm sought: and again dividing the last quotient by 1,000020724, the next less number, the quotient is 1,000002291, the next less than which in the 7th class gives 9 for the 7th figure of the logarithm: and dividing the last quotient by 1,000002072, the quotient is 1,000000219, which gives 9 in the 8th class for the 8th figure of the logarithm: and again the last quotient 1,000000219 being divided by 1,000000207 the next less, the quotient 1,000000012 gives 5 in the same 8th class, when one figure is cut off, for the 9th figure of the logarithm sought. All

which figures collected together give 3,301029995 for Briggs's logarithm of 2000, the index 3 being supplied; which logarithm is true in the last figure.

To find the number answering to any given logarithm, as suppose to 3,3010300: omitting the characteristic, against the other figures 3, 0, 1, 0, 3, 0, 0, as in the first column in the margin, are the several numbers as in the second column, found from their respective 1st, 2d, 3d, &c.

classes; the effective numbers of which multiplied continually together, the last product is 2,000000019966, which, because the characteristic is three, gives 2000,000019966 or 2000 only for the required number answering to the given logarithm.

§ 9. Mr Hutton's Practical Rule for the Construction of Logarithms.

THE methods laid down in the above sections are abundantly sufficient to show the various principles upon which logarithms may be constructed; though there are still a variety of others which our limits will not admit of our inserting: The following rule is added from Mr Hutton's Treatise on the subject, for the sake of those who do not choose to enter deeply into these investigations.

Call x the sum of any number whose logarithm is sought, and the number next less by unity; divide $\cdot 8685889638$, &c. (or $2 \div 2,3025$, &c.) by x , and reserve the quotient; divide the reserved quotient by the square of x , and reserve this quotient; divide this last quotient also by the square of x , and again reserve this quotient; and thus proceed continually, dividing the last quotient by the square of x as long as division can be made. Then write these quotients orderly under one another, the first uppermost, and divide them respectively by the uneven numbers 1, 3, 5, 7, 9, 11, &c. as long as division can be made; that is, divide the 1st reserved quotient by 1, the 2d by 3, the 3d by 5, the 4th by 7, &c. Add all these last quotients together, and the sum will be the logarithm of $b+a$; and therefore to this logarithm add also the logarithm

Construc-
tion of
Logarithms

arithm of a the next less number, and the sum will be the required logarithm of b the number proposed.

Ex. 1. To find the Log of 2.—Here the next less number is 1, and $2+1=3=z$, whose square is 9. Then,

3)	868588964	1)	289529654	289529654
9)	289529654	3)	32169962	10723321
9)	32169962	5)	3574440	714888
9)	3574440	7)	397160	56737
9)	397160	9)	44129	4903
9)	44129	11)	4903	446
9)	4903	13)	545	42
9)	545	15)	61	4
9)	61			

Log. $\frac{1}{2}$ - .301029995

Add L. 1 - .00000000

Log of 2 - .301029995

Ex. 2. To find the log. of 3.—Here the next less number is 2, and $2+3=5=z$, whose square is 25, to divide by which always multiply by .04. Then

5)	868588964	1)	173717793	173717793
25)	173717793	3)	6948712	2316237
25)	6948712	5)	277948	55590
25)	277948	7)	11118	1588
25)	11118	9)	448	50
25)	448	11)	18	2
	18			

L. $\frac{1}{2}$ - .176091260

L. 2 add - .301029995

L. 3 - .477121255

Then because the sum of the logarithms of numbers gives the logarithm of their product, and the difference of the logarithms gives the logarithm of the quotient of the numbers, from the above two logarithms, and the logarithm of 10, which is 1, we may raise a great many logarithms, thus:

Ex. 3. Because $2 \times 2 = 4$, therefore

to L. 2 - .301029995

add L. 2 - .301029995

sum is L. 4 - .602059991

Ex. 4. Because $2 \times 3 = 6$, therefore

to L. 2 - .301029995

add L. 3 - .477121255

sum is L. 6 - .778151250

Ex. 5. Because $2^2 = 8$, therefore

L. 2 - .301029995

mult. by 2 - 3

gives L. 8 - .903089987

Ex. 6. Because $3^2 = 9$, therefore

L. 3 - .477121255

mult. by 2 - 2

gives L. 9 - .954242509

Ex. 7. Because $1^2 = 1$, therefore

from L. 10 - 1.000000000

take L. 2 - .301029995

leaves L. 5 - .698970004

Ex. 8. Because $12 = 3 \times 4$, therefore

to L. 3 - .477121255

add L. 4 - .602059991

gives L. 12 - 1.079181246

And thus by computing, by the general rule, the logarithms of the other prime numbers 7, 11, 13, 17, 19, 23, &c.: and then using composition and division, we may easily find as many logarithms as we please, or may speedily examine any logarithm in the table.

§ 10. Mr Thomas Atkinson of Ballifhannon's Method.

In any series of numbers in a geometrical progression, beginning from unity, as in the margin, the series is composed of a 0 1 2 3 set of continued proportionals, of 1 10 100 1000 which the member standing nearest to unity is the common ratio or rate of the proportion. If over or under these another series is placed, as in the example, of numbers in an arithmetical progression, beginning with nought, and whose common difference is unity, the members of this series are called *indexes*; for they serve to show how many successive multiplications have been made with the common rate to produce that member of the geometrical progression over which each of these indexes does severally stand.

This theory may be considered in another light: If the square root of 10 (that is, of the common rate) is found, it is a mean proportional between 1 and 10, and becomes a new common rate for a new set of continued proportionals, as in the margin. And if the 0 .5 1 1.5 2 2.5 half of unity, which in 1 3.16 10 31.6 100 316. the former case was the additional difference of the arithmetical progression, is made the additional difference of this new series, and noted as in the example, a new combination is formed of two series agreeing with the first in these remarkable properties, viz. If any two members of the geometrical progression are multiplied together, the sum of their corresponding indexes will become the index of their product; and conversely, if any of them is divided by any other, the difference of their indexes will be found to be the index of the quotient. This theory is indefinite; and repeated extractions may be made with any proposed number of decimals, and bisection made of the corresponding indexes, until one has no more number to work with; and each of the mean proportionals thus found between 1 and 10, will be found a member of every new geometrical progression formed by every smaller root; and consequently all the roots thus found, together with their corresponding indexes, have, in cases of multiplication or division, the same connection as has been just described.

Let those successive roots be found, and noted in the form of a table, and, in another column, let the corresponding indexes found by these directions be regularly

Contraction of Logarithms. larily noted, each opposite to its own roots. These indexes are commonly known by the denomination of *logarithms*; the roots themselves may be called *natural numbers*.

These roots are composed of natural numbers freedom or never wanted; but from them the logarithms of such as are of general use may be thus found.

Suppose 2 the proposed number, one must examine the table of roots; there he will find 3.16, &c. &c. the nearest to 2 of those which are greater; and 1.778, &c. &c. also nearest to it of those which are less. He

may make a division at his pleasure, either $\frac{3.16}{2}$ or $\frac{2}{1.77}$; yet let the choice fall on what will yield the

$\frac{2}{1.77} = 1.1246$, &c. &c. smallest quotient, and let the circumstances of the calculation be noted, as in the margin, for future direction. Here

.0000087837, &c. .0000038147 its logm0000057968 of the quotient.
.0000025175, its logm.

Thus knowing that 0.0000025175, or such like, is the logm. of the last quotient, one may have that of 2, if he will but call to mind the following circumstances.

In every case of division, if he has logarithms of quotient and divisor, he has also that of the dividend, by adding the two first together: if he has the logarithm of the dividend, and that of either the divisor or quotient, he may find that of the other; for he has only to subtract what he knows from the logarithm of the dividend, the remainder is what he wants: and lastly, that in every division he made, he took one number from the table of roots whose logarithm is known, being noted in the table, and which he made use of as his direction either as a dividend or a divisor: From these circumstances, one may, by the help of the logarithm just found, discover the logarithm of that number of the last division, whether it be dividend or divisor, which was the quotient of the preceding division; and thus, tracing his own work backwards by his notes from quotient to quotient, be they ever so few or ever so many, he will come at last by addition and subtraction to the logarithm of the proposed number.

By this method, the logarithm of any number within the compass of the table of roots may be found: if a greater is proposed, suppose 9495, it must be made 9.495, and its logarithm found; then it must be re-

— 3.301029995664 the logarithm of the fraction given.
7 the power to which it is to be raised.

— 19.107209969648 the logarithm of the answer.

This differs from the like work in whole numbers only in this, that, in multiplying the decimals, one has at last 2 to be carried from them to the whole numbers; this is to be considered as + 2, then— $3 \times 7 = -21$, and— $21 + 2 = -19$ to be noted the index of the answer. Extraction of the roots is only the converse of this. Suppose—19.107209969648 given, to find that root whose exponent number is 7.

$\frac{2}{1.77} = 1.1246$. With this quotient let the table be applied to as before, and 1.1246, &c. will be found to be between 1.154, &c. &c. and 1.074, &c. &c. and division to be made as in the example. In this manner one is to proceed with each successive quotient, till at length he has one in which the number of the initial decimal noughts is equal at least, if not greater than that of the significant figures. Here the work of division may be discontinued; and as it will rarely happen, that one will not have an additional initial nought for every division, the number cannot be great in calculations of a moderate extent. Having at last found a quotient such as was described, and supposing the number of decimals to be 10, one may readily find the logm. of that quotient thus:—Suppose the quotient 1.0000057968; he is to look into the table of roots for those noted with 5 initial decimal noughts, and from any one of these and its corresponding logm. state thus:

flored to the proposed form, and have a proper index noted before the decimals just found. How to do this is too well known to have occasion to mention it here.

The reason for finding the logarithm of the last quotient by the common proportion is this: He who has made a table of roots, will find, by inspection only, that as initial noughts come into the decimal parts of the roots, the significant figures just immediately following them do assume the form of a geometrical progression, descending, whose common rate or divisor is 2, as is just the case with the whole of the decimals of the corresponding logarithms; and that the number of the significant figures endowed with this property is generally equal to that of the initial noughts: so far as this, and no farther, the common proportion will hold between the significant figures of the decimals in the roots and the same number of places in the logarithms; and for this reason it was needed to continue the successive divisions till a quotient was found so circumstanced, that its logarithm could be found by the proportion.

The same gentleman hath also favoured us with the following new method

Of extracting Roots of Fractions by LOGARITHMS.

THE easiest way to explain this, is first to give an example of involving such numbers.

As 7 is the exponent number here, one may in his mind multiply it by 2 for a trial, as in common division; but the product = 14 being less than 19, must be rejected; then he may try it with 3, this yields 21 for a product. This 3 must be noted with a negative sign for the index of the new logarithm. Then, on comparing 19 with 21, the difference is

— 19.107209969648
— 3.301029995664

Explanation of the Table.

2. This 2 must be carried as 20 to the decimals, and one must from that carry on the division of the de-

cimals with 7 for a divisor, as is usually done in other cases.

Explanation of the Table.

Another EXAMPLE.

Suppose -1.4771212545 given, to extract the root of its 5th power.

-1.8954252109 the logarithm of the root.

For 5, the exponent of the root $\times 1$ is greater than the index of the given logarithm, and 4 is the remainder. Then -1 becomes the index of the logarithm of the root; and 4= the overplus, is to be carried as 40 to the decimals; and from that, division is to be made with 5 as a divisor for the rest of the work.

SECT. III. *Explanation and Use of the Table, with a general Account of the various Sciences to which Logarithms may be applied.*

§ 1. To find by the table the Logarithm of any number.

If the number be under 100, it is easily found in the first division at the head of the first page; if it be betwixt 100 and 1000, over against the number in the first column of the following pages, in the next column under 0 will be found the logarithm required. If the number be betwixt 1000 and 10000, the first three figures of the number are to be found in the column marked N° and the fourth figure at the top, and in the column under it, lineally against the first three figures, will be found the logarithm required, changing the index 2 into 3. The column marked Diff. and showing the common difference by which each of these columns increases, serves to find the logarithms of numbers beyond 10000. Thus,

To find the logarithm for a number greater than any in the common canon, but less than 10000000.—Cut off four figures on the left of the given number, and seek the logarithm in the table; add as many unites to the index as there are figures remaining on the right; subtract the logarithm found from the next following it in the table; then, as the difference of numbers in the canon is to the tabular distance of the logarithms answering to them, so are the remaining figures of the given number to the logarithmic difference; which, if it be added to the logarithm before found, the sum will be the logarithm required. Suppose v. gr. the logarithm of the number 92375 required. Cut off the four figures 9237, and to the characteristic of the logarithm corresponding to them, add an unit; then,

From the logarithm of the numb. $9238 = 3.965578$
Subtract logarithm. numb. $-9237 = 3.965531$

Remains tabular difference 47
Then $10 : 47 :: 5 : 23$

Now to the logarithm 4.965531

Add the difference found -23

The sum is the logarithm required. -4.965554

Or more briefly; find the logarithm of the first four figures as before; then multiply the common difference which stands against it by the remaining figures of the given number; from the product, cut off as many figures at the right hand as you multiplied by, and add the remainder to the logarithm before found, fitting it with a proper index. Thus $47 \times 5 = 235$; cut off 5 and add 23.

To find the logarithm of a fraction.—Subtract the logarithm of the numerator from that of the denominator, and to the remainder prefix the sign of subtraction. N° 184.

traction. Thus suppose it required to find the logarithm of the fraction $\frac{7}{3}$.

Logarithm of 7 = 0.845098

Logarithm of 3 = 0.477121

Logarithm of $\frac{7}{3} = -0.367977$

The reason of the rule is, that a fraction being the quotient of the numerator divided by the denominator, its logarithm must be the difference of the logarithms of those two; so that the numerator being subtracted from the denominator, the difference becomes negative. Stifelius observed, that the logarithms of a proper fraction must always be negative, if that of unity be 0; which is evident, a fraction being less than one.

Or, the logarithm of the denominator, though greater than that of the numerator, as in the case of a proper fraction, may be subtracted from it, regard being had to the sign of the index, which alone in that case is negative. Thus,

Log. of 3 = 0.477121

Log. of 7 = 0.845098

Log. of $\frac{7}{3} = 1.632023$ which produces the same effect in any operation as that before found, viz. -0.367977 , this being to be subtracted, and the other to be added.

Or again, the fraction may be reduced to a decimal, and its logarithm found; which differs from that of a whole number only in the index, which is to be negative.

For an improper fraction v. gr. $\frac{7}{3}$, its numerator being greater than its denominator, its logarithm is had by subtracting the logarithm of the latter from that of the former.

The logarithm of 9 = 0.9542425

Logarithm of 5 = 0.6989700

Logarithm $\frac{7}{3} = 0.2552725$

In the same manner may a logarithm of a mixed number, as $3\frac{2}{3}$, be found, it being first reduced into an improper fraction $\frac{11}{3}$.

Or, this improper fraction may be reduced to a mixed number, whose logarithm must be found as if it were wholly integral, and its index taken according to the integral part. We shall here observe, that the logarithms of whole numbers are added, subtracted, &c. according to the rules of these operations in decimal arithmetic; but with regard to the management of logarithms with negative indices, the same rules are to be observed as those given in algebra for like and unlike signs.

In addition, all the figures except the index, are reckoned positive, and therefore the figure to be carried to the index from the other part of the logarithm takes away so much from the negative index. Thus $1.8683326 + 3.698972 = 1.562298$. In subtraction, if either one or both of the logarithms have negative indices, you must change the sign of the index of the sub-

sub-

Explanation of the Table, &c.

subtrahend, after you have carried it to what may arise from the decimal part, and then add the indices: thus $1.562298 - 1.863326 = 3.698972$. In multiplication, what is carried from the product of the other parts of the logarithms must be subtracted from the product of the indices: thus $2.477121 \times 5 = 8.385605$. In division, if the divisor will exactly measure the index, proceed as in common arithmetick; e. g. $4.924782 \div 2 = 2.462391$. But if the divisor will not exactly measure the index, add units to the index, till you can exactly divide it, and carry these units to the next number: e. g. $8.385605 \div 5 = 2.477121$.

To find the number corresponding to any given logarithm.—If the logarithm be within the limits of the table, i. e. if its index does not exceed 3, then neglecting the index, look down in the column of logarithms under 0, for the two or three first figures of your given logarithm; and if you exactly find all the figures of the given logarithm in that column, you have the number corresponding at the left hand: But if you do not find your logarithm exactly in the column under 0, you must run through the other columns till you find it exactly, or till you obtain the next least logarithm; and in the column of numbers lineally against it, you have the first 3 figures of the number sought, to which join the figure over the column, where your logarithm or its next least was found, and you have the corresponding number, e. gr. the number answering to the logarithm 3.544812 is 3506.

If the index of this logarithm had been 1, then the two last figures of the number would have been decimal; with the index 0, its corresponding number would have been 3506; with 1, 3506; with 2, 03506, &c.

If the logarithm cannot be found exactly, take the next least, and make the difference between the given logarithm and the next least the numerator of a fraction whose denominator shall be the common difference, and add the fraction to the number found in the table.

To find the number corresponding to a logarithm greater than any in the table.—First, from the given logarithm, subtract the logarithm of 10, or 100, or 1000, or 10,000, till you have a logarithm that will come within the compass of the table; find the number corresponding to this, and multiply it by 10, or 100, or 1000, or 10,000, the product is the number required.

Suppose, for instance, the number corresponding to the logarithm 7.758982 be required: subtract the logarithm of the number 10,000, which is 4.0000000, from 7.758982; the remainder is 3.758982, the number corresponding to which is 5741 $\frac{1}{100}$: this multiplied by 10,000, the product is 5741100, the number required.

Otherwise seek the decimal member of the logarithm in the table, and if you can find it exactly, you have the four first figures of the number in the table, to which affix as many ciphers as the given index exceeds 3, and it is the number required. But if you cannot find the logarithm exactly, take the next least, and find the four first figures of the corresponding number; then take the difference betwixt the given logarithm and the next least, and annex to it as many ciphers as the index exceeds 3; then divide by the common dif-

ference, and affix the quotient to the four first figures, and you have the number required.

To find the number corresponding to a negative logarithm. To the given negative logarithm add the last logarithm of the table, or that of the number 10000; i. e. subtract the first from the second, and find the number corresponding to the remainder; this will be the numerator of the fraction, whose denominator will be 10000; v. gr. suppose it to be required to find the fraction corresponding to the negative logarithm

0.3679767, subtract this from
4.0000000

The remainder is — 3.6320233, the number corresponding to which is 4285 $\frac{1}{1000}$, the fraction sought therefore is $\frac{4285}{1000}$. The reason of the rule is, that as a fraction is the quotient, arising on the division of the numerator by the denominator, unity will be to the fraction as the denominator to the numerator; but as unity is to the fraction corresponding to the given negative logarithm, so is 10000 to the number corresponding to the remainder: therefore, if 10000 be taken for the denominator, the number will be the numerator of the fraction required.

The negative logarithm — 0.3679777 is equal to the logarithm 1.632023, and the number answering to it, found in the manner already directed, will be 4285 $\frac{1}{1000}$.

The sines, tangents, &c. of any arch are easily found: by seeking the degree at the top, if the arch be less than 45°, and the minutes at the side, beginning from the top, and by seeking the degree, &c. at the bottom, if the arch be greater than 45°. If a given logarithmic sine or tangent falls between those in the tables, then the corresponding degrees and minutes may be reckoned $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{1}{4}$, &c. minutes more than those belonging to the nearest less logarithm in the tables, according as its difference from the given one is $\frac{1}{2}$, or $\frac{1}{3}$, or $\frac{1}{4}$, &c. of the difference between the logarithm next greater and next less than the given log.

§ 2. Of the various Sciences to which Logarithms may be applied.

As these artificial numbers constitute a new species of arithmetic capable of performing every thing which can be done in the old way, it is plain that its use must be equally extensive, and that in every science in which common arithmetic can be useful, the logarithmical arithmetic must be much more so, by reason of its being more easily performed. Though the general principles of logarithmical arithmetic have been already laid down, we shall here, in order to render the subject still more plain, subjoin the following practical rules.

I. Multiplication by Logarithms.

Add together the logarithms of all the factors, and the sum is a logarithm, the natural number corresponding to which will be the product required.

Observing to add, to the sum of the affirmative indices, what is carried from the sum of the decimal parts of the logarithms.

And that the difference betwixt the affirmative and negative indices is to be taken for the index to the logarithm of the product.

Explanation of the Table, &c.

Division by *Ex. 1.* To multiply 23.14 by 5.062.
 Logarithms 23.14 its log. is 1.3643634
 5.062 its log. is 0.7043221

Product 117.1347 - 2.0686855
Ex. 2. To mult. 2.581926 by 3.457291.
 2.581926 its log. is 0.4119438
 3.457291 - 0.5387359

Prod. 8.92647 - 0.9506797
Ex. 3. To mult. 3.902, and 597.16, and .0314728
 all together.

3.902 its log. is 0.5912873
 597.16 - 2.7760907
 .0314728 - 2.4979353

Prod. 73.33533 - 1.8653133
 The 2 cancels the 2, and the 1 to carry from the decimals is set down.

Ex. 4. To mult. 35.86, and 2.1046,
 and 0.8372, and 0.0294 all together.
 35.86 its log. is 0.5546103
 2.1046 - 0.3231696
 0.8372 - 1.9228292
 0.0294 - 2.4683473

Prod. 1.857618 - 1.2689564
 Here the 2 to carry cancels the 2, and there remain the 7 to set down.

II. Division by Logarithms.

From the logarithm of the dividend subtract the logarithm of the divisor, the remainder is a logarithm whose corresponding number will be the quotient required.

But first observe to change the sign of the index of the logarithm of the divisor, viz. from negative to affirmative, or from affirmative to negative; then take the sum of the indices if they be of the same kind, or their difference when of different signs, with the sign of the greater, for the index to the logarithm of the quotient.

And when 1 is borrowed in the left-hand place of the decimal part of the logarithm, add it to the index of the logarithm of the divisor when that index is affirmative, but subtract it when negative; then let the index thus found be changed, and worked with as before.

Ex. 1. To divide 24163 by 4567.
 Divide 24163 its log. 4.3831509
 Divif. 4567 - 3.6596310

Quot. 5.290782 - 0.7235199

Ex. 2. To divide 37.149 by 523.76.
 Divid. 37.149 its log. 1.5699471
 Divif. 523.76 - 2.7191323

Quot. .07092752 - 2.8508148

Ex. 3. To divide .06314 by .007241.
 Divid. .06314 its log. 2.8003046
 Divif. .007241 - 3.8597985

Quot. 8.719792 - 0.9405061

Here 1 carried from the decimals to the 3 makes it become 2, which taken from the other 2, leaves 0 remaining.

Ex. 4. To divide .7438 by 12.9476.
 Divid. .7438 its log. 1.8714562
 Divif. 12.9476 - 1.1121893

Quot. .05744694 - 2.7592669

Here the 1 taken from the 1 makes it become 2 to set down.

III. The Rule of Three, or Proportion.

Add the logarithms of the 2d and 3d terms together, and from their sum subtract the logarithm of the 1st by the foregoing rules; the remainder will be the logarithm of the 4th term required.

Or in any compound proportion whatever, add together the logarithms of all the terms that are to be multiplied, and from that sum take the sum of the others; the remainder will be the logarithm of the term sought.

But instead of subtracting any logarithm, we may add its complement, and the result will be the same. By the complement is meant the logarithm of the reciprocal of the given number, or the remainder by taking the given logarithm from 0, or from 10, changing the radix from 0 to 10; the easiest method of doing which, is to begin at the left hand, and subtract each figure from 9, except the last significant figure on the right-hand, which must be subtracted from 10. But when the index is negative, add it to 9, and subtract the rest as before. And for every complement that is added, subtract 10 from the last sum of the indices.

Ex. 1. To find a 4th proportional to 72.34, and 2.519, and 357.4862.

As 72.34 - comp. log. 8.1406215
 To 2.519 - 0.4012282
 So 357.4862 - 2.5532592

To 12.44827 - 1.0951089

Ex. 2. To find a 3d proportional to 12.796 and 3.24718.

As 12.796 - comp. log. 8.8929258
 To 3.24718 - 0.5115064
 So 3.24718 - 0.5115064

To .8240216 - 1.9159386

Ex. 3. To find a number in proportion to .379145 as .85132 is to .0649.

As .0649 - comp. log. 1.11877553
 To .85132 - 1.9300928
 So .379145 - 1.5788054

To 4.973401 - 0.6966535

Ex. 4. If the interest of 100l. for a year or 365 days be 4.5l. what will be the interest of 279.25l. for 274 days?

As $\begin{cases} 100 \\ 365 \end{cases}$ comp. log. $\begin{cases} 8.0000000 \\ 7.4377071 \end{cases}$
 To 279.25 - 2.4459932
 274 - 2.4377506
 So 4.5 - 0.6532125

To 9.433296 - 0.9746634

Evolution
by Loga-
rithms.

IV. *Evolution, or raising of Powers.*

Multiply the logarithm of the number given by the proposed index of the power, and the product will be the logarithm of the power sought.

Note. In multiplying a logarithm with a negative index by any affirmative number, the product will be negative.---But what is to be carried from the decimal part of the logarithm will be affirmative.---Therefore the difference will be the index of the product; and is to be accounted of the same kind with the greater.

Ex. 1. To find the 2d power of 25791.

Root 25791 its log.	-	0.4114682
index	-	2
		<hr/> 0.8229364

Power 6561756 - - - 0.8229364

Ex. 2. To find the cube of 307146.

Root 307146 its log.	-	0.4873449
index	-	3
		<hr/> 1.4620347

Power 2897575 - - - 1.4620347

Ex. 3. To find the 4th power of 09163.

Root 09163 its log.	-	2.9620377
index	-	4
		<hr/> 11.8481508

Power 0000704938 - - - 11.8481508

Here 4 times the negative index being 8, and 3 to carry, the difference 5 is the index of the product.

Ex. 4. To find the 365th power of 10045.

Root 10045 its log	-	0.0019499
index	+	365
		<hr/> 0.70495

Power 5148888 - - - 0.7117135

V. *Evolution, or Extraction of Roots.*

Divide the logarithm of the power or given number by its index, and the quotient will be the logarithm of the root required.

Note. When the index of the logarithm is negative, and the divisor is not exactly contained in it without a remainder, increase it by such a number as will

make it exactly divisible; and carry the units borrowed, as so many tens, to the left-hand place of the decimal part of the logarithm; then divide the results by the index of the root.

Evolution
by Loga-
rithms.

Ex. 1. To find the square root of 365.

Power 365	-	-	2)25622929
Root 1910498	-	-	12811465

Ex. 2. To find the cube root of 12345.

Power 12345	-	-	10)40914911
Root 2311162	-	-	13638304

Ex. 3. To find the 10th root of 2.

Power 2	-	-	10)03010300
Root 1071773	-	-	03010300

Ex. 4. To find the 365th root of 1045.

Power 1045	-	-	365)00191163
Root 1000121	-	-	00000524

Ex. 5. To find the square root of 093.

Power 093	-	-	2)29684829
Root 304959	-	-	14842415

Here the divisor 2 is contained exactly once in 2 the negative index; therefore the index of the quotient is 1.

Ex. 6. To find the cube root of 00048.

Power	-	-	3)46812412
Root 07829735	-	-	28937471

Here the divisor 3 not being exactly contained in 4, augment it by 2, to make it become 6, in which the divisor is contained just 2 times; and the 2 borrowed being carried to the other figures 6, &c. makes 26812412, which divided by 3 gives 8937471.

In trigonometry, the use of logarithmical sines, tangents, &c. are used as well as the common arithmetical logarithms; and by using them according to the rules above laid down, the operations are shortened to a degree altogether incredible to persons unacquainted with this invention. With equal facility are the problems in astronomy and navigation solved by their means, as well as those of the higher geometry, fluxions, and in short every thing which requires deep and laborious calculation. For the particular application of them to the different sciences, see the articles NAVIGATION, TRIGONOMETRY, &c.

A TABLE OF LOGARITHMS from 1 to 10,000.

N ^o	Logar.	N ^o	Logar.	N ^o	Logar.	N ^o	Logar.	N ^o	Logar.	N ^o	Logar.	N ^o	Logar.	N ^o	Logar.
1	0.000000	12	1.079181	23	1.361728	34	1.531479	45	1.653212	56	1.748188	67	1.826075	78	1.892095
2	0.301030	13	1.113043	24	1.380211	35	1.544068	46	1.662758	57	1.758755	68	1.832508	79	1.897627
3	0.477121	14	1.146128	25	1.397940	36	1.556302	47	1.672098	58	1.763428	69	1.838849	80	1.903090
4	0.602060	15	1.176091	26	1.414973	37	1.568202	48	1.681241	59	1.770852	70	1.845098	81	1.908485
5	0.698970	16	1.204120	27	1.431364	38	1.579784	49	1.690196	60	1.778151	71	1.851258	82	1.913814
6	0.778151	17	1.230449	28	1.447158	39	1.591065	50	1.698970	61	1.785330	72	1.857332	83	1.919078
7	0.845098	18	1.255272	29	1.462398	40	1.602060	51	1.707570	62	1.792392	73	1.863323	84	1.924279
8	0.903090	19	1.278754	30	1.477121	41	1.612784	52	1.716003	63	1.799340	74	1.869232	85	1.929419
9	0.954242	20	1.301030	31	1.491362	42	1.623249	53	1.724276	64	1.806180	75	1.875061	86	1.934498
10	1.000000	21	1.322219	32	1.505150	43	1.633468	54	1.732391	65	1.812913	76	1.880814	87	1.939519
11	1.041393	22	1.342423	33	1.518514	44	1.643453	55	1.740361	66	1.819544	77	1.886491	88	1.944483
														89	1.949390
														90	1.954242
														91	1.959041
														92	1.963788
														93	1.968483
														94	1.973128
														95	1.977724
														96	1.982271
														97	1.986772
														98	1.991226
														99	1.995635

N ^o	0	1	2	3	4	5	6	7	8	9	Diff.
100	2.000000	2.000434	2.000868	2.001301	2.001734	2.002166	2.002598	2.003029	2.003460	2.003891	432
101	2.004321	2.004753	2.005180	2.005609	2.006038	2.006466	2.006894	2.007321	2.007748	2.008174	428
102	2.008606	2.009026	2.009451	2.009876	2.010300	2.010724	2.011147	2.011570	2.011993	2.012415	424
103	2.012837	2.013259	2.013680	2.014100	2.014520	2.014940	2.015360	2.015779	2.016197	2.016615	419
104	2.017033	2.017451	2.017868	2.018284	2.018700	2.019116	2.019532	2.019947	2.020361	2.020775	416
105	2.021189	2.021603	2.022016	2.022438	2.022841	2.023252	2.023664	2.024075	2.024486	2.024896	412
106	2.025307	2.025715	2.026124	2.026533	2.026942	2.027350	2.027757	2.028164	2.028571	2.028978	408
107	2.029384	2.029788	2.030195	2.030600	2.031004	2.031408	2.031812	2.032216	2.032619	2.033021	404
108	2.033424	2.033826	2.034227	2.034628	2.035029	2.035430	2.035830	2.036229	2.036629	2.037028	400
109	2.037426	2.037825	2.038223	2.038620	2.039017	2.039414	2.039811	2.040207	2.040602	2.040998	396
110	2.041393	2.041787	2.042182	2.042575	2.042969	2.043362	2.043755	2.044148	2.044540	2.044931	393
111	2.045323	2.045715	2.046105	2.046495	2.046885	2.047275	2.047664	2.048053	2.048442	2.048830	389
112	2.049218	2.049606	2.049993	2.050380	2.050766	2.051152	2.051538	2.051924	2.052309	2.052694	386
113	2.053078	2.053463	2.053846	2.054230	2.054613	2.054996	2.055378	2.055760	2.056142	2.056524	382
114	2.056905	2.057286	2.057666	2.058046	2.058426	2.058805	2.059185	2.059563	2.059942	2.060320	379
115	2.060698	2.061075	2.061452	2.061829	2.062206	2.062582	2.062958	2.063333	2.063709	2.064083	376
116	2.064458	2.064832	2.065206	2.065580	2.065953	2.066326	2.066698	2.067071	2.067443	2.067814	372
117	2.068186	2.068557	2.068928	2.069298	2.069668	2.070038	2.070407	2.070776	2.071145	2.071514	369
118	2.071882	2.072250	2.072617	2.072985	2.073352	2.073718	2.074085	2.074451	2.074816	2.075182	366
119	2.075547	2.075912	2.076276	2.076640	2.077004	2.077368	2.077731	2.078094	2.078457	2.078819	363
120	2.079181	2.079543	2.079904	2.080266	2.080626	2.080987	2.081347	2.081707	2.082067	2.082426	360
121	2.082785	2.083144	2.083503	2.083861	2.084219	2.084576	2.084934	2.085291	2.085647	2.086001	357
122	2.086360	2.086716	2.087071	2.087426	2.087781	2.088136	2.088490	2.088845	2.089198	2.089552	353
123	2.089905	2.090258	2.090611	2.090963	2.091315	2.091667	2.092018	2.092370	2.092721	2.093071	351
124	2.093422	2.093772	2.094122	2.094471	2.094820	2.095169	2.095518	2.095866	2.096215	2.096562	349
125	2.096910	2.097257	2.097604	2.097951	2.098297	2.098644	2.098990	2.099335	2.099681	2.100026	346
126	2.100371	2.100715	2.101059	2.101403	2.101747	2.102090	2.102434	2.102777	2.103119	2.103462	343
127	2.103804	2.104145	2.104488	2.104828	2.105169	2.105510	2.105851	2.106191	2.106531	2.106870	340
128	2.107210	2.107549	2.107888	2.108227	2.108565	2.108903	2.109241	2.109578	2.109916	2.110253	338
129	2.110590	2.110926	2.111262	2.111598	2.111934	2.112270	2.112605	2.112940	2.113275	2.113609	335
130	2.113943	2.114277	2.114611	2.114944	2.115278	2.115610	2.115943	2.116276	2.116608	2.116940	333
131	2.117271	2.117603	2.117934	2.118265	2.118595	2.118926	2.119256	2.119586	2.119915	2.120245	330
132	2.120574	2.120903	2.121231	2.121560	2.121888	2.122216	2.122543	2.122871	2.123198	2.123525	328
133	2.123852	2.124178	2.124504	2.124830	2.125156	2.125481	2.125806	2.126131	2.126456	2.126781	325
134	2.127105	2.127429	2.127754	2.128076	2.128399	2.128722	2.129045	2.129368	2.129690	2.130012	323
135	2.130334	2.130655	2.130977	2.131298	2.131619	2.131939	2.132260	2.132580	2.132900	2.133219	321
136	2.133539	2.133858	2.134177	2.134496	2.134814	2.135133	2.135451	2.135768	2.136086	2.136403	318
137	2.136721	2.137037	2.137354	2.137670	2.137987	2.138303	2.138618	2.138934	2.139249	2.139564	316
138	2.139879	2.140194	2.140508	2.140822	2.141136	2.141450	2.141765	2.142079	2.142393	2.142707	314
139	2.143015	2.143327	2.143639	2.143951	2.144263	2.144574	2.144885	2.145196	2.145507	2.145818	311

N ^o .	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	Diff.
140	2.146128	2.146438	2.146748	2.147058	2.147367	2.147676	2.147985	2.148294	2.148603	2.148911	309
141	2.149219	2.149527	2.149835	2.150142	2.150449	2.150756	2.151063	2.151370	2.151676	2.151982	307
142	2.152288	2.152594	2.152900	2.153205	2.153510	2.153815	2.154119	2.154424	2.154728	2.155032	303
143	2.155388	2.155694	2.155993	2.156294	2.156599	2.156892	2.157184	2.157475	2.157759	2.158041	303
144	2.158362	2.158664	2.158965	2.159266	2.159567	2.159868	2.160168	2.160468	2.160769	2.161068	301
145	2.161368	2.161667	2.161967	2.162266	2.162564	2.162863	2.163161	2.163459	2.163757	2.164055	299
146	2.164353	2.164650	2.164947	2.165244	2.165541	2.165838	2.166134	2.166430	2.166726	2.167022	297
147	2.167317	2.167613	2.167908	2.168203	2.168497	2.168792	2.169086	2.169380	2.169674	2.169968	295
148	2.170262	2.170555	2.170848	2.171141	2.171434	2.171726	2.172019	2.172311	2.172603	2.172895	293
149	2.173186	2.173478	2.173769	2.174060	2.174351	2.174641	2.174932	2.175222	2.175512	2.175802	291
150	2.176091	2.176381	2.176670	2.176959	2.177248	2.177536	2.177825	2.178113	2.178401	2.178689	289
151	2.178977	2.179264	2.179552	2.179839	2.180126	2.180413	2.180699	2.180986	2.181272	2.181558	287
152	2.181844	2.182129	2.182415	2.182700	2.182985	2.183270	2.183554	2.183839	2.184123	2.184407	285
153	2.184691	2.184975	2.185259	2.185542	2.185826	2.186108	2.186391	2.186674	2.186956	2.187239	283
154	2.187521	2.187803	2.188084	2.188366	2.188647	2.188928	2.189209	2.189490	2.189771	2.190051	281
155	2.190332	2.190612	2.190892	2.191171	2.191451	2.191730	2.192009	2.192288	2.192567	2.192846	279
156	2.193125	2.193403	2.193681	2.193959	2.194237	2.194514	2.194792	2.195069	2.195346	2.195623	278
157	2.195900	2.196176	2.196452	2.196729	2.197005	2.197280	2.197556	2.197832	2.198107	2.198382	276
158	2.198657	2.198932	2.199206	2.199481	2.199755	2.200029	2.200303	2.200577	2.200850	2.201124	274
159	2.201397	2.201670	2.201943	2.202216	2.202488	2.202761	2.203033	2.203305	2.203577	2.203848	272
160	2.204120	2.204391	2.204662	2.204933	2.205204	2.205475	2.205745	2.206016	2.206286	2.206556	271
161	2.206826	2.207095	2.207365	2.207634	2.207903	2.208172	2.208441	2.208710	2.208978	2.209247	269
162	2.209515	2.209783	2.210051	2.210318	2.210586	2.210853	2.211120	2.211388	2.211654	2.211921	267
163	2.212188	2.212454	2.212720	2.212986	2.213252	2.213518	2.213783	2.214049	2.214314	2.214579	266
164	2.214844	2.215109	2.215373	2.215638	2.215902	2.216166	2.216430	2.216694	2.216957	2.217221	264
165	2.217484	2.217747	2.218010	2.218273	2.218535	2.218798	2.219060	2.219322	2.219584	2.219846	262
166	2.220108	2.220370	2.220631	2.220892	2.221153	2.221414	2.221675	2.221935	2.222196	2.222456	261
167	2.222716	2.222976	2.223236	2.223496	2.223755	2.224015	2.224274	2.224533	2.224792	2.225051	259
168	2.225309	2.225568	2.225826	2.226084	2.226342	2.226600	2.226858	2.227115	2.227372	2.227630	258
169	2.227887	2.228143	2.228400	2.228657	2.228913	2.229170	2.229426	2.229682	2.229938	2.230193	256
170	2.230449	2.230704	2.230960	2.231215	2.231470	2.231724	2.231979	2.232233	2.232488	2.232742	254
171	2.232996	2.233250	2.233504	2.233757	2.234011	2.234264	2.234517	2.234770	2.235023	2.235276	253
172	2.235528	2.235781	2.236033	2.236285	2.236537	2.236789	2.237041	2.237293	2.237544	2.237795	252
173	2.238046	2.238297	2.238548	2.238799	2.239049	2.239299	2.239549	2.239800	2.240050	2.240299	250
174	2.240549	2.240799	2.241048	2.241297	2.241546	2.241795	2.242044	2.242293	2.242541	2.242790	249
175	2.243038	2.243286	2.243534	2.243782	2.244030	2.244277	2.244524	2.244771	2.245018	2.245266	248
176	2.245513	2.245759	2.246006	2.246252	2.246499	2.246745	2.246991	2.247236	2.247482	2.247728	246
177	2.247973	2.248219	2.248464	2.248709	2.248954	2.249198	2.249443	2.249687	2.249932	2.250176	245
178	2.250426	2.250664	2.250902	2.251141	2.251385	2.251628	2.251871	2.252114	2.252357	2.252600	243
179	2.252853	2.253096	2.253338	2.253580	2.253822	2.254064	2.254306	2.254548	2.254790	2.255031	242
180	2.255272	2.255514	2.255755	2.255996	2.256236	2.256477	2.256718	2.256958	2.257199	2.257439	241
181	2.257679	2.257918	2.258158	2.258398	2.258637	2.258877	2.259116	2.259355	2.259594	2.259833	240
182	2.260071	2.260310	2.260549	2.260787	2.261025	2.261263	2.261501	2.261739	2.261976	2.262214	238
183	2.262451	2.262688	2.262925	2.263162	2.263399	2.263636	2.263873	2.264109	2.264345	2.264582	237
184	2.264818	2.265054	2.265290	2.265526	2.265761	2.265996	2.266232	2.266467	2.266702	2.266937	236
185	2.267172	2.267406	2.267641	2.267875	2.268110	2.268344	2.268578	2.268812	2.269046	2.269279	234
186	2.269653	2.269886	2.270119	2.270352	2.270585	2.270818	2.271051	2.271284	2.271517	2.271750	233
187	2.271982	2.272214	2.272446	2.272678	2.272910	2.273142	2.273374	2.273606	2.273838	2.274070	232
188	2.274301	2.274532	2.274764	2.274995	2.275226	2.275457	2.275688	2.275919	2.276150	2.276381	230
189	2.276612	2.276843	2.277074	2.277305	2.277536	2.277767	2.277998	2.278229	2.278460	2.278691	229
190	2.278922	2.279153	2.279384	2.279615	2.279846	2.280077	2.280308	2.280539	2.280770	2.280999	228
191	2.281230	2.281461	2.281692	2.281923	2.282154	2.282385	2.282616	2.282847	2.283078	2.283309	227
192	2.283539	2.283770	2.283999	2.284229	2.284459	2.284689	2.284919	2.285149	2.285379	2.285609	226
193	2.285839	2.286069	2.286299	2.286529	2.286759	2.286989	2.287219	2.287449	2.287679	2.287909	225
194	2.288139	2.288369	2.288599	2.288829	2.289059	2.289289	2.289519	2.289749	2.289979	2.290209	223

N°	0	1	2	3	4	5	6	7	8	9	Diff.
195	2.290035	2.290257	2.290480	2.290702	2.290925	2.291147	2.291369	2.291591	2.291813	2.292034	222
196	2.292256	2.292478	2.292699	2.292920	2.293141	2.293362	2.293583	2.293804	2.294025	2.294246	221
197	2.294466	2.294687	2.294907	2.295127	2.295347	2.295567	2.295787	2.296007	2.296226	2.296446	220
198	2.296665	2.296884	2.297104	2.297323	2.297542	2.297760	2.297979	2.298198	2.298416	2.298635	219
199	2.298853	2.299071	2.299289	2.299507	2.299725	2.299943	2.300160	2.300378	2.300595	2.300813	218
200	2.301030	2.301247	2.301464	2.301681	2.301898	2.302114	2.302331	2.302547	2.302764	2.302980	217
201	2.303196	2.303412	2.303628	2.303844	2.304059	2.304275	2.304490	2.304706	2.304921	2.305136	216
202	2.305351	2.305566	2.305781	2.305996	2.306210	2.306425	2.306639	2.306854	2.307068	2.307282	215
203	2.307496	2.307710	2.307924	2.308137	2.308351	2.308564	2.308778	2.308991	2.309204	2.309417	214
204	2.309630	2.309843	2.310056	2.310268	2.310481	2.310693	2.310906	2.311118	2.311330	2.311542	212
205	2.311754	2.311966	2.312177	2.312389	2.312600	2.312812	2.313023	2.313234	2.313445	2.313656	211
206	2.313867	2.314078	2.314289	2.314499	2.314710	2.314920	2.315130	2.315340	2.315550	2.315760	210
207	2.315970	2.316180	2.316390	2.316599	2.316809	2.317018	2.317227	2.317436	2.317645	2.317854	209
208	2.318063	2.318272	2.318481	2.318689	2.318898	2.319106	2.319314	2.319523	2.319730	2.319938	208
209	2.320146	2.320354	2.320562	2.320769	2.320977	2.321184	2.321391	2.321598	2.321805	2.322012	207
210	2.322219	2.322426	2.322633	2.322839	2.323046	2.323252	2.323458	2.323664	2.323871	2.324077	206
211	2.324282	2.324488	2.324694	2.324899	2.325105	2.325310	2.325516	2.325721	2.325926	2.326131	205
212	2.326336	2.326541	2.326745	2.326950	2.327154	2.327359	2.327563	2.327767	2.327972	2.328176	204
213	2.328380	2.328583	2.328787	2.328991	2.329194	2.329398	2.329601	2.329804	2.330008	2.330211	203
214	2.330414	2.330617	2.330819	2.331022	2.331225	2.331427	2.331629	2.331832	2.332034	2.332236	202
215	2.332438	2.332640	2.332842	2.333044	2.333246	2.333447	2.333649	2.333850	2.334051	2.334253	202
216	2.334454	2.334655	2.334856	2.335056	2.335257	2.335458	2.335658	2.335859	2.336059	2.336259	201
217	2.336460	2.336660	2.336860	2.337060	2.337260	2.337459	2.337659	2.337858	2.338058	2.338257	200
218	2.338456	2.338655	2.338855	2.339054	2.339253	2.339451	2.339650	2.339849	2.340047	2.340246	199
219	2.340444	2.340642	2.340840	2.341039	2.341235	2.341434	2.341632	2.341830	2.342028	2.342225	198
220	2.342423	2.342620	2.342817	2.343014	2.343212	2.343409	2.343605	2.343802	2.343999	2.344196	197
221	2.344392	2.344589	2.344785	2.344981	2.345178	2.345374	2.345570	2.345766	2.345961	2.346157	196
222	2.346353	2.346548	2.346744	2.346939	2.347135	2.347330	2.347525	2.347720	2.347915	2.348110	195
223	2.348305	2.348500	2.348694	2.348889	2.349083	2.349277	2.349472	2.349666	2.349860	2.350054	194
224	2.350248	2.350442	2.350636	2.350829	2.351023	2.351216	2.351409	2.351603	2.351796	2.351989	193
225	2.352182	2.352375	2.352568	2.352761	2.352954	2.353146	2.353339	2.353532	2.353724	2.353916	193
226	2.354108	2.354301	2.354493	2.354684	2.354876	2.355068	2.355260	2.355451	2.355643	2.355834	192
227	2.356026	2.356217	2.356408	2.356599	2.356790	2.356981	2.357172	2.357363	2.357554	2.357744	191
228	2.357935	2.358125	2.358316	2.358506	2.358696	2.358886	2.359076	2.359266	2.359456	2.359646	190
229	2.359835	2.360025	2.360215	2.360404	2.360593	2.360783	2.360972	2.361161	2.361350	2.361539	189
230	2.361728	2.361917	2.362106	2.362294	2.362482	2.362671	2.362859	2.363048	2.363236	2.363424	188
231	2.363612	2.363800	2.363988	2.364176	2.364363	2.364551	2.364739	2.364926	2.365113	2.365301	187
232	2.365488	2.365675	2.365862	2.366049	2.366236	2.366423	2.366609	2.366796	2.366983	2.367169	186
233	2.367356	2.367542	2.367728	2.367915	2.368101	2.368287	2.368473	2.368659	2.368844	2.369030	185
234	2.369216	2.369401	2.369587	2.369772	2.369958	2.370143	2.370328	2.370513	2.370698	2.370883	184
235	2.371068	2.371253	2.371437	2.371622	2.371806	2.371991	2.372175	2.372360	2.372544	2.372728	184
236	2.372912	2.373096	2.373280	2.373464	2.373647	2.373831	2.374015	2.374198	2.374382	2.374565	183
237	2.374748	2.374931	2.375115	2.375298	2.375481	2.375664	2.375846	2.376029	2.376212	2.376394	182
238	2.376577	2.376759	2.376942	2.377124	2.377306	2.377488	2.377670	2.377852	2.378034	2.378216	181
239	2.378398	2.378580	2.378761	2.378943	2.379124	2.379305	2.379487	2.379668	2.379849	2.380030	181
240	2.380211	2.380392	2.380573	2.380754	2.380934	2.381115	2.381296	2.381476	2.381656	2.381837	181
241	2.382017	2.382197	2.382377	2.382557	2.382737	2.382917	2.383097	2.383277	2.383456	2.383636	180
242	2.383815	2.383995	2.384175	2.384355	2.384533	2.384712	2.384891	2.385070	2.385249	2.385427	179
243	2.385606	2.385785	2.385964	2.386142	2.386321	2.386499	2.386677	2.386855	2.387034	2.387212	178
244	2.387390	2.387568	2.387746	2.387923	2.388101	2.388279	2.388456	2.388634	2.388811	2.388989	178
245	2.389166	2.389343	2.389520	2.389697	2.389874	2.390051	2.390228	2.390405	2.390582	2.390758	177
246	2.390935	2.391112	2.391288	2.391464	2.391641	2.391817	2.391993	2.392169	2.392345	2.392521	176
247	2.392697	2.392873	2.393048	2.393224	2.393400	2.393575	2.393751	2.393926	2.394101	2.394276	176
248	2.394452	2.394627	2.394802	2.394977	2.395152	2.395326	2.395501	2.395676	2.395850	2.396025	175
249	2.396199	2.396374	2.396548	2.396722	2.396896	2.397070	2.397245	2.397418	2.397592	2.397766	174

Nº	0	1	2	3	4	5	6	7	8	9	Diff
250	2.397940	2.398114	2.398287	2.398461	2.398634	2.398808	2.398981	2.399154	2.399327	2.399501	173
251	2.399674	2.399847	2.400020	2.400192	2.400365	2.400538	2.400711	2.400883	2.401056	2.401228	173
252	2.401401	2.401573	2.401745	2.401917	2.402089	2.402261	2.402433	2.402605	2.402777	2.402949	173
253	2.403120	2.403291	2.403464	2.403635	2.403807	2.403978	2.404149	2.404320	2.404492	2.404663	171
254	2.404834	2.405005	2.405175	2.405346	2.405517	2.405688	2.405858	2.406029	2.406199	2.406370	171
255	2.406540	2.406710	2.406881	2.407051	2.407221	2.407391	2.407561	2.407731	2.407900	2.408070	170
256	2.408240	2.408409	2.408579	2.408749	2.408918	2.409087	2.409257	2.409426	2.409595	2.409764	169
257	2.409933	2.410102	2.410271	2.410440	2.410608	2.410777	2.410946	2.411114	2.411283	2.411451	168
258	2.411620	2.411788	2.411956	2.412124	2.412292	2.412460	2.412628	2.412796	2.412964	2.413132	168
259	2.413300	2.413467	2.413635	2.413802	2.413970	2.414137	2.414305	2.414472	2.414639	2.414806	167
260	2.414973	2.415140	2.415307	2.415474	2.415641	2.415808	2.415974	2.416141	2.416308	2.416474	167
261	2.416640	2.416807	2.416973	2.417139	2.417306	2.417472	2.417638	2.417804	2.417970	2.418135	166
262	2.418301	2.418467	2.418633	2.418798	2.418964	2.419129	2.419295	2.419460	2.419625	2.419791	165
263	2.419956	2.420121	2.420286	2.420451	2.420616	2.420781	2.420945	2.421110	2.421275	2.421439	165
264	2.421604	2.421768	2.421933	2.422097	2.422261	2.422426	2.422590	2.422755	2.422918	2.423082	164
265	2.423246	2.423410	2.423573	2.423737	2.423901	2.424064	2.424228	2.424391	2.424555	2.424718	164
266	2.424882	2.425045	2.425208	2.425371	2.425534	2.425697	2.425860	2.426023	2.426186	2.426349	163
267	2.426511	2.426674	2.426836	2.426999	2.427161	2.427324	2.427486	2.427648	2.427811	2.427973	162
268	2.428135	2.428297	2.428459	2.428621	2.428784	2.428946	2.429108	2.429268	2.429429	2.429591	162
269	2.429752	2.429914	2.430075	2.430236	2.430398	2.430559	2.430720	2.430881	2.431042	2.431203	161
270	2.431364	2.431525	2.431685	2.431846	2.432007	2.432167	2.432328	2.432488	2.432649	2.432809	160
271	2.432965	2.433125	2.433286	2.433446	2.433606	2.433767	2.433927	2.434088	2.434248	2.434409	160
272	2.434569	2.434728	2.434888	2.435048	2.435207	2.435366	2.435526	2.435685	2.435844	2.436003	159
273	2.436163	2.436322	2.436481	2.436640	2.436798	2.436957	2.437116	2.437275	2.437433	2.437592	159
274	2.437751	2.437909	2.438067	2.438226	2.438384	2.438542	2.438700	2.438858	2.439016	2.439175	158
275	2.439333	2.439491	2.439648	2.439806	2.439964	2.440122	2.440279	2.440439	2.440594	2.440752	158
276	2.440909	2.441066	2.441224	2.441381	2.441538	2.441695	2.441852	2.442009	2.442166	2.442323	157
277	2.442480	2.442636	2.442793	2.442950	2.443106	2.443263	2.443419	2.443576	2.443732	2.443888	157
278	2.444045	2.444201	2.444357	2.444513	2.444669	2.444825	2.444981	2.445137	2.445293	2.445448	156
279	2.445654	2.445810	2.445965	2.446121	2.446276	2.446432	2.446587	2.446742	2.446897	2.447052	155
280	2.447158	2.447313	2.447468	2.447623	2.447778	2.447933	2.448088	2.448242	2.448397	2.448552	155
281	2.448706	2.448861	2.449015	2.449170	2.449324	2.449478	2.449633	2.449787	2.449941	2.450095	154
282	2.450259	2.450413	2.450567	2.450721	2.450875	2.451028	2.451182	2.451336	2.451489	2.451643	154
283	2.451786	2.451940	2.452093	2.452247	2.452400	2.452553	2.452706	2.452859	2.453012	2.453165	153
284	2.453318	2.453471	2.453624	2.453777	2.453930	2.454082	2.454235	2.454387	2.454540	2.454692	153
285	2.454845	2.454997	2.455149	2.455302	2.455454	2.455606	2.455758	2.455910	2.456062	2.456214	152
286	2.456366	2.456518	2.456670	2.456821	2.456973	2.457125	2.457276	2.457428	2.457579	2.457730	152
287	2.457882	2.458033	2.458184	2.458336	2.458487	2.458638	2.458789	2.458940	2.459091	2.459242	151
288	2.459392	2.459543	2.459694	2.459845	2.459995	2.460146	2.460296	2.460447	2.460597	2.460747	151
289	2.460898	2.461048	2.461198	2.461348	2.461498	2.461649	2.461799	2.461948	2.462098	2.462248	150
290	2.462398	2.462548	2.462697	2.462847	2.462997	2.463146	2.463295	2.463445	2.463594	2.463744	150
291	2.463893	2.464042	2.464191	2.464340	2.464489	2.464638	2.464787	2.464936	2.465085	2.465234	149
292	2.465383	2.465532	2.465680	2.465829	2.465977	2.466125	2.466274	2.466423	2.466571	2.466719	148
293	2.466868	2.467016	2.467164	2.467312	2.467460	2.467608	2.467756	2.467904	2.468052	2.468199	148
294	2.468347	2.468495	2.468643	2.468790	2.468938	2.469085	2.469232	2.469380	2.469527	2.469675	147
295	2.469822	2.469969	2.470116	2.470263	2.470410	2.470557	2.470704	2.470851	2.470998	2.471145	147
296	2.471292	2.471438	2.471585	2.471732	2.471878	2.472024	2.472171	2.472317	2.472464	2.472610	146
297	2.472756	2.472903	2.473049	2.473195	2.473341	2.473487	2.473633	2.473779	2.473925	2.474070	146
298	2.474216	2.474362	2.474508	2.474653	2.474799	2.474944	2.475089	2.475235	2.475381	2.475526	146
299	2.475671	2.475816	2.475962	2.476107	2.476252	2.476396	2.476542	2.476687	2.476832	2.476976	145
300	2.477121	2.477266	2.477411	2.477555	2.477700	2.477844	2.477989	2.478133	2.478278	2.478422	145
301	2.478566	2.478711	2.478855	2.478999	2.479143	2.479287	2.479431	2.479575	2.479719	2.479863	144
302	2.480007	2.480151	2.480294	2.480438	2.480582	2.480725	2.480869	2.481012	2.481156	2.481299	144
303	2.481443	2.481586	2.481729	2.481872	2.482016	2.482159	2.482302	2.482445	2.482588	2.482731	143
304	2.482874	2.483016	2.483159	2.483302	2.483445	2.483587	2.483730	2.483872	2.484015	2.484157	143

N ^o	0	1	2	3	4	5	6	7	8	9	Diff.
305	2.484300	2.484442	2.484584	2.484727	2.484869	2.485011	2.485153	2.485295	2.485437	2.485579	142
306	2.485721	2.485863	2.486005	2.486147	2.486289	2.486430	2.486572	2.486714	2.486855	2.486997	142
307	2.487138	2.487280	2.487421	2.487563	2.487704	2.487845	2.487986	2.488127	2.488267	2.488408	141
308	2.488551	2.488692	2.488833	2.488973	2.489114	2.489255	2.489396	2.489537	2.489677	2.489818	141
309	2.489958	2.490099	2.490239	2.490380	2.490520	2.490661	2.490801	2.490941	2.491081	2.491222	140
310	2.491362	2.491502	2.491642	2.491782	2.491922	2.492062	2.492201	2.492341	2.492481	2.492621	140
311	2.492760	2.492900	2.493040	2.493179	2.493319	2.493458	2.493597	2.493737	2.493876	2.494015	139
312	2.494155	2.494294	2.494433	2.494572	2.494711	2.494850	2.494989	2.495128	2.495267	2.495406	139
313	2.505543	2.494583	2.495822	2.495960	2.496099	2.496237	2.496376	2.496514	2.496653	2.496791	139
314	2.496930	2.497068	2.497205	2.497344	2.497482	2.497621	2.497759	2.497897	2.498035	2.498173	138
315	2.498311	2.498448	2.498586	2.498724	2.498861	2.498999	2.499137	2.499275	2.499412	2.499549	138
316	2.499687	2.499824	2.499962	2.500099	2.500236	2.500374	2.500511	2.500648	2.500785	2.500922	137
317	2.501059	2.501196	2.501333	2.501470	2.501607	2.501744	2.501880	2.502017	2.502154	2.502290	137
318	2.502427	2.502564	2.502700	2.502837	2.502973	2.503109	2.503246	2.503382	2.503518	2.503654	136
319	2.503791	2.503927	2.504063	2.504199	2.504335	2.504471	2.504607	2.504743	2.504878	2.505014	136
320	2.505150	2.505286	2.505421	2.505557	2.505692	2.505828	2.505963	2.506099	2.506234	2.506369	135
321	2.506505	2.506640	2.506775	2.506911	2.507046	2.507181	2.507316	2.507451	2.507586	2.507721	135
322	2.507856	2.507991	2.508125	2.508260	2.508395	2.508530	2.508664	2.508799	2.508933	2.509068	135
323	2.509202	2.509337	2.509472	2.509606	2.509740	2.509874	2.509908	2.510143	2.510277	2.510411	134
324	2.510545	2.510679	2.510813	2.510947	2.511081	2.511215	2.511348	2.511482	2.511616	2.511749	134
325	2.511883	2.512017	2.512150	2.512284	2.512417	2.512551	2.512684	2.512818	2.512951	2.513084	133
326	2.513218	2.513351	2.513484	2.513617	2.513750	2.513883	2.514016	2.514149	2.514281	2.514415	133
327	2.514548	2.514680	2.514813	2.514946	2.515079	2.515211	2.515344	2.515476	2.515609	2.515741	133
328	2.515874	2.516006	2.516139	2.516271	2.516403	2.516535	2.516668	2.516799	2.516932	2.517064	132
329	2.517196	2.517328	2.517460	2.517592	2.517724	2.517855	2.517987	2.518119	2.518251	2.518382	132
330	2.518514	2.518645	2.518776	2.518909	2.519040	2.519171	2.519303	2.519434	2.519565	2.519697	131
331	2.519828	2.519959	2.520090	2.520221	2.520352	2.520483	2.520614	2.520745	2.520876	2.521007	131
332	2.521138	2.521269	2.521400	2.521530	2.521661	2.521792	2.521922	2.522053	2.522183	2.522314	131
333	2.522444	2.522575	2.522705	2.522835	2.522966	2.523096	2.523226	2.523356	2.523486	2.523616	130
334	2.523746	2.523876	2.524006	2.524136	2.524266	2.524396	2.524526	2.524656	2.524785	2.524915	130
335	2.525045	2.525174	2.525304	2.525433	2.525563	2.525692	2.525822	2.525951	2.526081	2.526210	129
336	2.526339	2.526468	2.526598	2.526727	2.526856	2.526985	2.527114	2.527243	2.527372	2.527501	129
337	2.527630	2.527759	2.527888	2.528016	2.528145	2.528274	2.528402	2.528531	2.528660	2.528788	129
338	2.528917	2.529045	2.529174	2.529302	2.529430	2.529559	2.529687	2.529815	2.529943	2.530072	128
339	2.530200	2.530328	2.530456	2.530584	2.530712	2.530839	2.530968	2.531095	2.531223	2.531351	128
340	2.531479	2.531607	2.531734	2.531862	2.531989	2.532117	2.532245	2.532372	2.532499	2.532627	128
341	2.532754	2.532882	2.533009	2.533136	2.533263	2.533391	2.533518	2.533645	2.533772	2.533899	127
342	2.534026	2.534153	2.534280	2.534407	2.534534	2.534661	2.534787	2.534914	2.535041	2.535167	127
343	2.535294	2.535421	2.535547	2.535674	2.535800	2.535927	2.536053	2.536179	2.536306	2.536432	126
344	2.536558	2.536685	2.536811	2.536937	2.537063	2.537189	2.537315	2.537441	2.537567	2.537693	126
345	2.537819	2.537945	2.538071	2.538197	2.538322	2.538448	2.538574	2.538699	2.538825	2.538951	126
346	2.539076	2.539202	2.539327	2.539452	2.539578	2.539704	2.539829	2.539954	2.540079	2.540204	125
347	2.540329	2.540455	2.540580	2.540705	2.540830	2.540955	2.541080	2.541205	2.541330	2.541455	125
348	2.541579	2.541704	2.541829	2.541953	2.542078	2.542203	2.542327	2.542452	2.542576	2.542701	125
349	2.542825	2.542950	2.543074	2.543199	2.543323	2.543447	2.543571	2.543696	2.543820	2.543944	124
350	2.544068	2.544192	2.544316	2.544440	2.544564	2.544688	2.544812	2.544936	2.545060	2.545183	124
351	2.545307	2.545431	2.545554	2.545678	2.545802	2.545925	2.546049	2.546172	2.546296	2.546419	124
352	2.546653	2.546776	2.546900	2.547023	2.547146	2.547269	2.547392	2.547515	2.547638	2.547761	123
353	2.547775	2.547898	2.548021	2.548144	2.548266	2.548389	2.548512	2.548635	2.548758	2.548881	123
354	2.549003	2.549126	2.549249	2.549371	2.549494	2.549616	2.549739	2.549861	2.549984	2.550106	123
355	2.550228	2.550351	2.550474	2.550595	2.550717	2.550840	2.550962	2.551084	2.551206	2.551328	122
356	2.551545	2.551667	2.551789	2.551910	2.552031	2.552152	2.552273	2.552394	2.552515	2.552636	122
357	2.552668	2.552790	2.552911	2.553032	2.553153	2.553274	2.553395	2.553516	2.553637	2.553758	121
358	2.553883	2.554004	2.554125	2.554246	2.554367	2.554488	2.554609	2.554730	2.554851	2.554972	121
359	2.555094	2.555215	2.555336	2.555457	2.555578	2.555699	2.555820	2.555940	2.556061	2.556182	121

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360	2.556302	2.556423	2.556544	2.556664	2.556785	2.556905	2.557026	2.557146	2.557266	2.557387	120
361	2.557507	2.557627	2.557748	2.557868	2.557988	2.558108	2.558228	2.558348	2.558469	2.558589	120
362	2.558709	2.558828	2.558948	2.559068	2.559188	2.559308	2.559428	2.559548	2.559667	2.559787	120
363	2.559907	2.560026	2.560146	2.560265	2.560385	2.560504	2.560624	2.560743	2.560863	2.560982	119
364	2.561101	2.561221	2.561340	2.561459	2.561578	2.561697	2.561817	2.561936	2.562055	2.562174	119
365	2.562293	2.562412	2.562531	2.562650	2.562768	2.562887	2.563006	2.563125	2.563243	2.563363	119
366	2.563481	2.563600	2.563718	2.563837	2.563955	2.564074	2.564192	2.564311	2.564429	2.564548	119
367	2.564666	2.564784	2.564903	2.565021	2.565139	2.565257	2.565375	2.565494	2.565611	2.565730	118
368	2.565848	2.565966	2.566084	2.566202	2.566320	2.566437	2.566555	2.566673	2.566791	2.566909	118
369	2.567026	2.567144	2.567262	2.567379	2.567497	2.567614	2.567732	2.567849	2.567967	2.568084	118
370	2.568202	2.568319	2.568436	2.568554	2.568671	2.568788	2.568905	2.569023	2.569140	2.569257	117
371	2.569374	2.569491	2.569608	2.569725	2.569842	2.569959	2.570076	2.570193	2.570309	2.570426	117
372	2.570543	2.570660	2.570776	2.570893	2.571010	2.571126	2.571243	2.571359	2.571476	2.571592	117
373	2.571709	2.571825	2.571942	2.572058	2.572174	2.572291	2.572407	2.572523	2.572639	2.572755	116
374	2.572872	2.572988	2.573104	2.573220	2.573336	2.573452	2.573568	2.573684	2.573800	2.573915	116
375	2.574031	2.574147	2.574263	2.574379	2.574494	2.574610	2.574726	2.574841	2.574957	2.575072	116
376	2.575188	2.575303	2.575419	2.575534	2.575650	2.575765	2.575880	2.575996	2.576111	2.576226	115
377	2.576341	2.576456	2.576571	2.576687	2.576802	2.576917	2.577032	2.577147	2.577262	2.577377	115
378	2.577492	2.577607	2.577722	2.577836	2.577951	2.578066	2.578181	2.578295	2.578410	2.578525	115
379	2.578639	2.578754	2.578868	2.578983	2.579097	2.579212	2.579326	2.579441	2.579555	2.579669	114
380	2.579784	2.579898	2.580012	2.580126	2.580240	2.580355	2.580469	2.580583	2.580697	2.580811	114
381	2.580925	2.581039	2.581153	2.581267	2.581381	2.581495	2.581608	2.581722	2.581836	2.581950	114
382	2.582063	2.582177	2.582291	2.582404	2.582518	2.582631	2.582745	2.582858	2.582972	2.583085	113
383	2.583199	2.583312	2.583425	2.583539	2.583652	2.583765	2.583879	2.583992	2.584105	2.584218	113
384	2.584331	2.584444	2.584557	2.584670	2.584783	2.584896	2.585009	2.585122	2.585235	2.585348	113
385	2.585461	2.585573	2.585686	2.585799	2.585912	2.586024	2.586137	2.586250	2.586362	2.586475	113
386	2.586587	2.586700	2.586812	2.586925	2.587037	2.587149	2.587262	2.587374	2.587486	2.587599	112
387	2.587711	2.587823	2.587935	2.588047	2.588160	2.588272	2.588384	2.588496	2.588608	2.588721	112
388	2.588832	2.588944	2.589055	2.589167	2.589279	2.589391	2.589503	2.589614	2.589726	2.589838	112
389	2.589950	2.590061	2.590173	2.590284	2.590396	2.590507	2.590619	2.590730	2.590842	2.590953	112
390	2.590953	2.591176	2.591287	2.591398	2.591510	2.591621	2.591732	2.591843	2.591955	2.592066	111
391	2.592177	2.592288	2.592399	2.592510	2.592621	2.592732	2.592843	2.592954	2.593064	2.593175	111
392	2.593286	2.593397	2.593508	2.593618	2.593729	2.593840	2.593950	2.594061	2.594171	2.594282	111
393	2.594392	2.594503	2.594613	2.594724	2.594834	2.594945	2.595055	2.595165	2.595276	2.595386	110
394	2.595496	2.595606	2.595717	2.595827	2.595937	2.596047	2.596157	2.596267	2.596377	2.596487	110
395	2.596597	2.596707	2.596817	2.596927	2.597037	2.597146	2.597256	2.597366	2.597476	2.597585	110
396	2.597695	2.597805	2.597914	2.598024	2.598134	2.598243	2.598353	2.598462	2.598572	2.598681	109
397	2.598790	2.598900	2.599009	2.599119	2.599228	2.599337	2.599446	2.599556	2.599665	2.599774	109
398	2.599883	2.599992	2.600101	2.600210	2.600319	2.600428	2.600537	2.600646	2.600755	2.600864	109
399	2.600973	2.601082	2.601190	2.601299	2.601408	2.601517	2.601625	2.601734	2.601843	2.601951	109
400	2.602060	2.602168	2.602277	2.602386	2.602494	2.602602	2.602711	2.602819	2.602928	2.603036	108
401	2.603144	2.603253	2.603361	2.603469	2.603577	2.603685	2.603794	2.603902	2.604010	2.604118	108
402	2.604226	2.604334	2.604442	2.604550	2.604658	2.604766	2.604874	2.604982	2.605089	2.605197	108
403	2.605305	2.605413	2.605520	2.605628	2.605736	2.605843	2.605951	2.606059	2.606166	2.606274	108
404	2.606381	2.606489	2.606596	2.606704	2.606811	2.606918	2.607026	2.607133	2.607240	2.607348	107
405	2.607455	2.607562	2.607669	2.607777	2.607884	2.607991	2.608098	2.608205	2.608312	2.608419	107
406	2.608526	2.608633	2.608740	2.608847	2.608954	2.609061	2.609167	2.609274	2.609381	2.609488	107
407	2.609594	2.609701	2.609808	2.609914	2.610021	2.610128	2.610234	2.610341	2.610447	2.610554	106
408	2.610660	2.610767	2.610873	2.610979	2.611086	2.611192	2.611298	2.611405	2.611511	2.611617	106
409	2.611723	2.611829	2.611936	2.612042	2.612148	2.612254	2.612360	2.612466	2.612572	2.612678	106
410	2.612784	2.612890	2.612996	2.613102	2.613207	2.613313	2.613419	2.613525	2.613630	2.613736	106
411	2.613842	2.613947	2.614053	2.614159	2.614264	2.614370	2.614475	2.614581	2.614686	2.614792	106
412	2.614897	2.615002	2.615108	2.615213	2.615319	2.615424	2.615529	2.615634	2.615740	2.615845	105
413	2.615950	2.616055	2.616160	2.616265	2.616370	2.616475	2.616580	2.616685	2.616790	2.616895	105
414	2.617000	2.617105	2.617210	2.617315	2.617420	2.617524	2.617629	2.617734	2.617839	2.617943	105

No	0	1	2	3	4	5	6	7	8	9	Diff.
415	2.618048	2.618153	2.618257	2.618362	2.618466	2.618571	2.618675	2.618780	2.618884	2.618989	105
416	2.619093	2.619198	2.619302	2.619406	2.619511	2.619615	2.619719	2.619823	2.619928	2.620032	104
417	2.620136	2.620240	2.620344	2.620448	2.620552	2.620656	2.620760	2.620864	2.620968	2.621072	104
418	2.621176	2.621280	2.621384	2.621488	2.621592	2.621695	2.621799	2.621903	2.622007	2.622110	104
419	2.622214	2.622318	2.622421	2.622525	2.622628	2.622732	2.622835	2.622939	2.623042	2.623146	104
420	2.623249	2.623353	2.623456	2.623559	2.623663	2.623766	2.623869	2.623972	2.624076	2.624179	104
421	2.624282	2.624385	2.624488	2.624591	2.624694	2.624798	2.624901	2.625004	2.625107	2.625209	103
422	2.625312	2.625415	2.625518	2.625621	2.625724	2.625827	2.625929	2.626032	2.626135	2.626238	103
423	2.626340	2.626443	2.626546	2.626648	2.626751	2.626853	2.626956	2.627058	2.627161	2.627263	103
424	2.627366	2.627468	2.627571	2.627673	2.627775	2.627878	2.627980	2.628082	2.628184	2.628287	102
425	2.628389	2.628491	2.628593	2.628695	2.628797	2.628899	2.629002	2.629104	2.629206	2.629308	102
426	2.629410	2.629511	2.629613	2.629715	2.629817	2.629919	2.630021	2.630123	2.630224	2.630326	102
427	2.630428	2.630529	2.630631	2.630733	2.630834	2.630936	2.631038	2.631139	2.631241	2.631342	102
428	2.631444	2.631545	2.631647	2.631748	2.631849	2.631951	2.632052	2.632153	2.632255	2.632356	101
429	2.632457	2.632558	2.632660	2.632761	2.632862	2.632963	2.633064	2.633165	2.633266	2.633367	101
430	2.633468	2.633569	2.633670	2.633771	2.633872	2.633973	2.634074	2.634175	2.634276	2.634377	100
431	2.634477	2.634578	2.634679	2.634779	2.634880	2.634981	2.635081	2.635182	2.635283	2.635383	100
432	2.635484	2.635584	2.635685	2.635785	2.635886	2.635986	2.636086	2.636187	2.636287	2.636388	100
433	2.636488	2.636588	2.636688	2.636789	2.636889	2.636989	2.637089	2.637189	2.637289	2.637390	100
434	2.637490	2.637590	2.637690	2.637790	2.637890	2.637990	2.638090	2.638190	2.638289	2.638389	99
435	2.638489	2.638589	2.638689	2.638789	2.638888	2.638988	2.639088	2.639188	2.639287	2.639387	99
436	2.639486	2.639586	2.639686	2.639785	2.639885	2.639984	2.640084	2.640183	2.640283	2.640382	99
437	2.640481	2.640581	2.640680	2.640779	2.640879	2.640978	2.641077	2.641176	2.641276	2.641375	99
438	2.641474	2.641573	2.641672	2.641771	2.641870	2.641970	2.642069	2.642168	2.642267	2.642366	99
439	2.642464	2.642563	2.642662	2.642761	2.642860	2.642959	2.643058	2.643156	2.643255	2.643354	99
440	2.643453	2.643551	2.643650	2.643749	2.643847	2.643946	2.644044	2.644143	2.644242	2.644340	98
441	2.644539	2.644637	2.644734	2.644833	2.644931	2.645029	2.645127	2.645226	2.645324	2.645422	98
442	2.645622	2.645720	2.645819	2.645917	2.646015	2.646113	2.646211	2.646309	2.646408	2.646506	98
443	2.646604	2.646702	2.646800	2.646898	2.646996	2.647094	2.647192	2.647290	2.647388	2.647486	98
444	2.647583	2.647681	2.647778	2.647876	2.647974	2.648072	2.648169	2.648267	2.648365	2.648462	98
445	2.648560	2.648658	2.648755	2.648853	2.648950	2.649048	2.649145	2.649243	2.649340	2.649437	97
446	2.649535	2.649632	2.649729	2.649826	2.649923	2.650020	2.650117	2.650214	2.650311	2.650408	97
447	2.650505	2.650602	2.650699	2.650796	2.650893	2.650989	2.651086	2.651183	2.651280	2.651377	97
448	2.651472	2.651569	2.651666	2.651762	2.651859	2.651956	2.652053	2.652150	2.652247	2.652344	97
449	2.652440	2.652536	2.652633	2.652730	2.652826	2.652923	2.653019	2.653116	2.653213	2.653310	97
450	2.653412	2.653509	2.653605	2.653702	2.653799	2.653895	2.653992	2.654089	2.654186	2.654283	96
451	2.654379	2.654475	2.654572	2.654668	2.654765	2.654861	2.654958	2.655054	2.655151	2.655248	96
452	2.655344	2.655440	2.655536	2.655633	2.655729	2.655825	2.655922	2.656018	2.656115	2.656212	96
453	2.656308	2.656404	2.656500	2.656596	2.656692	2.656789	2.656885	2.656981	2.657078	2.657174	96
454	2.657270	2.657366	2.657462	2.657558	2.657654	2.657750	2.657846	2.657942	2.658038	2.658134	96
455	2.658230	2.658326	2.658422	2.658518	2.658614	2.658710	2.658806	2.658902	2.659000	2.659096	95
456	2.659192	2.659288	2.659384	2.659480	2.659576	2.659672	2.659768	2.659864	2.659960	2.660056	95
457	2.660152	2.660248	2.660344	2.660440	2.660536	2.660632	2.660728	2.660824	2.660920	2.661016	95
458	2.661112	2.661208	2.661304	2.661400	2.661496	2.661592	2.661688	2.661784	2.661880	2.661976	95
459	2.662072	2.662168	2.662264	2.662360	2.662456	2.662552	2.662648	2.662744	2.662840	2.662936	95
460	2.663032	2.663128	2.663224	2.663320	2.663416	2.663512	2.663608	2.663704	2.663800	2.663896	94
461	2.663992	2.664088	2.664184	2.664280	2.664376	2.664472	2.664568	2.664664	2.664760	2.664856	94
462	2.664952	2.665048	2.665144	2.665240	2.665336	2.665432	2.665528	2.665624	2.665720	2.665816	94
463	2.665912	2.666008	2.666104	2.666200	2.666296	2.666392	2.666488	2.666584	2.666680	2.666776	94
464	2.666872	2.666968	2.667064	2.667160	2.667256	2.667352	2.667448	2.667544	2.667640	2.667736	94
465	2.667832	2.667928	2.668024	2.668120	2.668216	2.668312	2.668408	2.668504	2.668600	2.668696	93
466	2.668792	2.668888	2.668984	2.669080	2.669176	2.669272	2.669368	2.669464	2.669560	2.669656	93
467	2.669748	2.669844	2.669940	2.670036	2.670132	2.670228	2.670324	2.670420	2.670516	2.670612	93
468	2.670708	2.670804	2.670900	2.671000	2.671096	2.671192	2.671288	2.671384	2.671480	2.671576	93
469	2.671672	2.671768	2.671864	2.671960	2.672056	2.672152	2.672248	2.672344	2.672440	2.672536	93

N ^o	0	1	2	3	4	5	6	7	8	9	Diff.
470	2.672098	2.672190	2.672283	2.672375	2.672467	2.672560	2.672652	2.672744	2.672836	2.672929	92
471	2.673021	2.673113	2.673205	2.673297	2.673390	2.673482	2.673574	2.673666	2.673758	2.673850	92
472	2.673942	2.674034	2.674126	2.674218	2.674310	2.674402	2.674494	2.674586	2.674677	2.674769	92
473	2.674861	2.674953	2.675045	2.675136	2.675228	2.675320	2.675412	2.675503	2.675595	2.675687	92
474	2.675778	2.675870	2.675961	2.676053	2.676145	2.676236	2.676328	2.676419	2.676511	2.676602	92
475	2.676694	2.676785	2.676876	2.676968	2.677059	2.677150	2.677242	2.677333	2.677424	2.677516	91
476	2.677607	2.677698	2.677789	2.677881	2.677972	2.678063	2.678154	2.678245	2.678336	2.678427	91
477	2.678518	2.678609	2.678700	2.678791	2.678882	2.678973	2.679064	2.679155	2.679246	2.679337	91
478	2.679428	2.679519	2.679610	2.679701	2.679791	2.679882	2.679973	2.680063	2.680154	2.680245	91
479	2.680335	2.680426	2.680517	2.680607	2.680698	2.680789	2.680879	2.680970	2.681060	2.681151	91
480	2.681241	2.681332	2.681422	2.681513	2.681603	2.681693	2.681784	2.681874	2.681964	2.682055	90
481	2.682145	2.682235	2.682326	2.682416	2.682506	2.682596	2.682686	2.682777	2.682867	2.682957	90
482	2.683047	2.683137	2.683227	2.683317	2.683407	2.683497	2.683587	2.683677	2.683767	2.683857	90
483	2.683947	2.684037	2.684127	2.684217	2.684307	2.684396	2.684486	2.684576	2.684666	2.684756	90
484	2.684845	2.684935	2.685025	2.685114	2.685204	2.685294	2.685383	2.685472	2.685563	2.685652	90
485	2.685742	2.685831	2.685921	2.686010	2.686100	2.686189	2.686279	2.686368	2.686457	2.686547	89
486	2.686636	2.686726	2.686815	2.686904	2.686994	2.687083	2.687172	2.687261	2.687351	2.687440	89
487	2.687529	2.687618	2.687707	2.687796	2.687885	2.687975	2.688064	2.688153	2.688242	2.688331	89
488	2.688420	2.688509	2.688598	2.688687	2.688776	2.688865	2.688953	2.689042	2.689131	2.689220	89
489	2.689309	2.689398	2.689486	2.689575	2.689664	2.689753	2.689841	2.689930	2.690019	2.690107	89
490	2.690196	2.690285	2.690373	2.690462	2.690550	2.690639	2.690727	2.690816	2.690905	2.690993	89
491	2.691081	2.691170	2.691258	2.691347	2.691435	2.691523	2.691611	2.691700	2.691788	2.691877	88
492	2.691965	2.692053	2.692142	2.692230	2.692318	2.692406	2.692494	2.692583	2.692671	2.692759	88
493	2.692847	2.692935	2.693023	2.693111	2.693199	2.693287	2.693375	2.693463	2.693551	2.693639	88
494	2.693727	2.693815	2.693903	2.693991	2.694078	2.694166	2.694254	2.694342	2.694430	2.694517	88
495	2.694605	2.694693	2.694781	2.694868	2.694956	2.695044	2.695131	2.695219	2.695306	2.695394	88
496	2.695482	2.695569	2.695657	2.695744	2.695832	2.695919	2.696007	2.696094	2.696182	2.696269	87
497	2.696356	2.696444	2.696531	2.696618	2.696706	2.696793	2.696880	2.696968	2.697055	2.697142	87
498	2.697229	2.697316	2.697404	2.697491	2.697578	2.697665	2.697752	2.697839	2.697926	2.698013	87
499	2.698100	2.698188	2.698275	2.698362	2.698448	2.698535	2.698622	2.698709	2.698796	2.698883	87
500	2.698970	2.699057	2.699144	2.699230	2.699317	2.699404	2.699491	2.699578	2.699664	2.699751	87
501	2.699838	2.699924	2.700011	2.700098	2.700184	2.700271	2.700357	2.700444	2.700531	2.700617	87
502	2.700704	2.700790	2.700877	2.700963	2.701050	2.701136	2.701222	2.701309	2.701395	2.701482	86
503	2.701568	2.701654	2.701741	2.701827	2.701913	2.701999	2.702086	2.702172	2.702258	2.702344	86
504	2.702430	2.702517	2.702603	2.702689	2.702775	2.702861	2.702947	2.703033	2.703119	2.703205	86
505	2.703291	2.703377	2.703463	2.703549	2.703635	2.703721	2.703807	2.703893	2.703979	2.704065	86
506	2.704150	2.704236	2.704322	2.704408	2.704494	2.704579	2.704665	2.704751	2.704837	2.704922	86
507	2.705008	2.705094	2.705179	2.705265	2.705350	2.705436	2.705522	2.705607	2.705693	2.705778	86
508	2.705864	2.705949	2.706035	2.706120	2.706205	2.706291	2.706376	2.706462	2.706547	2.706632	85
509	2.706718	2.706803	2.706888	2.706974	2.707059	2.707144	2.707229	2.707315	2.707400	2.707485	85
510	2.707569	2.707655	2.707740	2.707826	2.707911	2.707996	2.708081	2.708166	2.708251	2.708336	85
511	2.708421	2.708506	2.708591	2.708676	2.708761	2.708846	2.708931	2.709015	2.709100	2.709185	85
512	2.709270	2.709355	2.709440	2.709524	2.709609	2.709694	2.709779	2.709863	2.709948	2.710033	85
513	2.710117	2.710202	2.710287	2.710371	2.710455	2.710540	2.710625	2.710710	2.710794	2.710879	85
514	2.710963	2.711048	2.711132	2.711216	2.711301	2.711385	2.711470	2.711554	2.711638	2.711723	84
515	2.711807	2.711891	2.711976	2.712060	2.712144	2.712229	2.712313	2.712397	2.712481	2.712565	84
516	2.712650	2.712734	2.712818	2.712902	2.712986	2.713070	2.713154	2.713238	2.713322	2.713406	84
517	2.713490	2.713574	2.713658	2.713742	2.713826	2.713910	2.713994	2.714078	2.714162	2.714246	84
518	2.714330	2.714414	2.714497	2.714581	2.714665	2.714749	2.714832	2.714916	2.715000	2.715084	84
519	2.715167	2.715251	2.715335	2.715418	2.715502	2.715586	2.715669	2.715753	2.715836	2.715920	84
520	2.716003	2.716087	2.716170	2.716254	2.716337	2.716421	2.716504	2.716588	2.716671	2.716754	83
521	2.716838	2.716921	2.717004	2.717088	2.717171	2.717254	2.717338	2.717421	2.717504	2.717587	83
522	2.717670	2.717753	2.717837	2.717920	2.718003	2.718086	2.718169	2.718253	2.718336	2.718419	83
523	2.718502	2.718585	2.718668	2.718751	2.718834	2.718917	2.719000	2.719083	2.719166	2.719248	83
524	2.719331	2.719414	2.719497	2.719580	2.719663	2.719745	2.719828	2.719911	2.719994	2.720077	83

Nº	0	1	2	3	4	5	6	7	8	9	Diff.
525	2.720159	2.720242	2.720325	2.720407	2.720490	2.720573	2.720655	2.720738	2.720821	2.720903	82
526	2.720986	2.721068	2.721151	2.721233	2.721316	2.721398	2.721481	2.721563	2.721646	2.721728	82
527	2.721811	2.721893	2.721975	2.722058	2.722140	2.722222	2.722305	2.722387	2.722469	2.722552	82
528	2.722634	2.722716	2.722798	2.722881	2.722963	2.723045	2.723127	2.723209	2.723291	2.723373	82
529	2.723456	2.723538	2.723620	2.723702	2.723784	2.723866	2.723948	2.724030	2.724112	2.724194	82
530	2.724276	2.724358	2.724440	2.724522	2.724603	2.724685	2.724767	2.724849	2.724931	2.725013	82
531	2.725094	2.725176	2.725258	2.725340	2.725421	2.725503	2.725585	2.725667	2.725748	2.725830	82
532	2.725912	2.725993	2.726075	2.726156	2.726238	2.726320	2.726401	2.726483	2.726564	2.726646	82
533	2.726727	2.726809	2.726890	2.726972	2.727053	2.727134	2.727216	2.727297	2.727379	2.727460	81
534	2.727541	2.727623	2.727704	2.727785	2.727866	2.727948	2.728029	2.728110	2.728191	2.728273	81
535	2.728354	2.728435	2.728516	2.728597	2.728678	2.728759	2.728841	2.728922	2.729003	2.729084	81
536	2.729165	2.729246	2.729327	2.729408	2.729489	2.729570	2.729651	2.729732	2.729813	2.729893	81
537	2.729974	2.730055	2.730136	2.730217	2.730298	2.730378	2.730459	2.730540	2.730621	2.730702	81
538	2.730782	2.730863	2.730944	2.731024	2.731105	2.731186	2.731266	2.731347	2.731428	2.731508	81
539	2.731589	2.731669	2.731750	2.731830	2.731911	2.731991	2.732072	2.732152	2.732233	2.732313	81
540	2.732394	2.732474	2.732555	2.732635	2.732715	2.732796	2.732876	2.732956	2.733037	2.733117	80
541	2.733197	2.733277	2.733358	2.733438	2.733518	2.733598	2.733679	2.733759	2.733839	2.733919	80
542	2.733999	2.734079	2.734159	2.734240	2.734320	2.734400	2.734480	2.734560	2.734640	2.734720	80
543	2.734800	2.734880	2.734960	2.735040	2.735120	2.735200	2.735279	2.735359	2.735439	2.735519	80
544	2.735599	2.735679	2.735758	2.735838	2.735918	2.735998	2.736078	2.736157	2.736237	2.736317	80
545	2.736396	2.736476	2.736556	2.736635	2.736715	2.736795	2.736874	2.736954	2.737034	2.737113	80
546	2.737193	2.737272	2.737352	2.737431	2.737511	2.737590	2.737670	2.737749	2.737829	2.737908	79
547	2.737987	2.738067	2.738146	2.738225	2.738305	2.738384	2.738463	2.738543	2.738622	2.738701	79
548	2.738781	2.738860	2.738939	2.739018	2.739097	2.739177	2.739256	2.739335	2.739414	2.739493	79
549	2.739572	2.739651	2.739730	2.739810	2.739889	2.739968	2.740047	2.740126	2.740205	2.740284	79
550	2.740363	2.740442	2.740521	2.740599	2.740678	2.740757	2.740836	2.740915	2.740994	2.741073	79
551	2.741152	2.741231	2.741309	2.741388	2.741467	2.741546	2.741624	2.741703	2.741782	2.741860	79
552	2.741939	2.742018	2.742096	2.742175	2.742254	2.742332	2.742411	2.742489	2.742568	2.742647	79
553	2.742725	2.742804	2.742882	2.742961	2.743039	2.743118	2.743196	2.743275	2.743353	2.743431	79
554	2.743510	2.743588	2.743666	2.743745	2.743823	2.743902	2.743980	2.744058	2.744136	2.744215	78
555	2.744293	2.744371	2.744449	2.744528	2.744606	2.744684	2.744762	2.744840	2.744919	2.744997	78
556	2.745075	2.745153	2.745231	2.745309	2.745387	2.745465	2.745543	2.745621	2.745699	2.745777	78
557	2.745855	2.745933	2.746011	2.746089	2.746167	2.746245	2.746323	2.746401	2.746479	2.746556	78
558	2.746634	2.746712	2.746790	2.746868	2.746945	2.747023	2.747101	2.747179	2.747256	2.747334	78
559	2.747412	2.747489	2.747567	2.747645	2.747722	2.747800	2.747878	2.747955	2.748033	2.748110	78
560	2.748188	2.748266	2.748343	2.748421	2.748498	2.748576	2.748653	2.748731	2.748808	2.748885	77
561	2.748963	2.749040	2.749118	2.749195	2.749272	2.749350	2.749427	2.749504	2.749582	2.749659	77
562	2.749737	2.749814	2.749891	2.749968	2.750045	2.750123	2.750200	2.750277	2.750354	2.750431	77
563	2.750508	2.750585	2.750663	2.750740	2.750817	2.750894	2.750971	2.751048	2.751125	2.751202	77
564	2.751279	2.751356	2.751433	2.751510	2.751587	2.751664	2.751741	2.751818	2.751895	2.751972	77
565	2.752048	2.752125	2.752202	2.752279	2.752356	2.752433	2.752509	2.752586	2.752663	2.752740	77
566	2.752816	2.752893	2.752970	2.753047	2.753123	2.753200	2.753277	2.753354	2.753431	2.753506	77
567	2.753588	2.753665	2.753742	2.753819	2.753896	2.753973	2.754050	2.754127	2.754204	2.754281	77
568	2.754348	2.754425	2.754501	2.754578	2.754654	2.754730	2.754807	2.754883	2.754960	2.755035	76
569	2.755112	2.755189	2.755265	2.755341	2.755417	2.755494	2.755570	2.755646	2.755722	2.755799	76
570	2.755873	2.755950	2.756027	2.756103	2.756180	2.756256	2.756332	2.756408	2.756484	2.756560	76
571	2.756635	2.756712	2.756788	2.756868	2.756944	2.757016	2.757092	2.757168	2.757244	2.757320	76
572	2.757390	2.757472	2.757548	2.757624	2.757700	2.757773	2.757851	2.757927	2.758003	2.758079	76
573	2.758155	2.758230	2.758306	2.758382	2.758458	2.758539	2.758609	2.758685	2.758761	2.758836	76
574	2.758912	2.758988	2.759063	2.759139	2.759214	2.759290	2.759366	2.759441	2.759517	2.759592	76
575	2.759668	2.759743	2.759819	2.759894	2.759970	2.760045	2.760121	2.760196	2.760272	2.760347	75
576	2.760422	2.760498	2.760573	2.760649	2.760724	2.760799	2.760875	2.760950	2.761025	2.761101	75
577	2.761176	2.761251	2.761326	2.761402	2.761477	2.761552	2.761627	2.761702	2.761778	2.761853	75
578	2.761928	2.762003	2.762078	2.762153	2.762228	2.762303	2.762378	2.762453	2.762528	2.762604	75
579	2.762679	2.762754	2.762829	2.762904	2.762978	2.763053	2.763128	2.763203	2.763278	2.763353	75

N ^o .	0.	1	2	3	4	5	6	7	8	9	Diff.
580	2.763428	2.763503	2.763578	2.763653	2.763727	2.763802	2.763877	2.763952	2.764027	2.764101	75
581	2.764176	2.764251	2.764326	2.764400	2.764475	2.764550	2.764624	2.764699	2.764774	2.764848	75
582	2.764923	2.764998	2.765072	2.765147	2.765221	2.765296	2.765370	2.765445	2.765520	2.765594	75
583	2.765666	2.765741	2.765816	2.765892	2.765966	2.766041	2.766115	2.766190	2.766264	2.766338	74
584	2.766413	2.766487	2.766562	2.766636	2.766710	2.766785	2.766859	2.766933	2.767007	2.767082	74
585	2.767156	2.767230	2.767304	2.767379	2.767453	2.767527	2.767601	2.767675	2.767749	2.767823	74
586	2.767898	2.767972	2.768046	2.768120	2.768194	2.768268	2.768343	2.768416	2.768490	2.768564	74
587	2.768638	2.768711	2.768786	2.768860	2.768934	2.769008	2.769082	2.769156	2.769230	2.769303	74
588	2.769377	2.769451	2.769525	2.769599	2.769673	2.769746	2.769820	2.769894	2.769968	2.770042	74
589	2.770115	2.770189	2.770263	2.770336	2.770410	2.770484	2.770557	2.770631	2.770705	2.770778	74
590	2.770852	2.770926	2.770999	2.771073	2.771146	2.771220	2.771293	2.771367	2.771440	2.771514	74
591	2.771587	2.771661	2.771734	2.771808	2.771881	2.771955	2.772028	2.772102	2.772175	2.772248	73
592	2.772322	2.772395	2.772468	2.772542	2.772615	2.772688	2.772762	2.772835	2.772908	2.772981	73
593	2.773055	2.773128	2.773201	2.773274	2.773348	2.773421	2.773494	2.773567	2.773640	2.773713	73
594	2.773786	2.773860	2.773933	2.774006	2.774079	2.774152	2.774225	2.774298	2.774371	2.774444	73
595	2.774517	2.774590	2.774663	2.774736	2.774809	2.774882	2.774955	2.775028	2.775100	2.775173	73
596	2.775246	2.775319	2.775392	2.775465	2.775538	2.775610	2.775683	2.775756	2.775829	2.775902	73
597	2.775974	2.776047	2.776120	2.776193	2.776265	2.776338	2.776411	2.776483	2.776556	2.776629	73
598	2.776701	2.776774	2.776846	2.776919	2.776992	2.777064	2.777137	2.777209	2.777282	2.777354	73
599	2.777427	2.777499	2.777572	2.777644	2.777717	2.777789	2.777862	2.777934	2.778006	2.778079	72
600	2.778151	2.778224	2.778296	2.778368	2.778441	2.778513	2.778585	2.778658	2.778730	2.778802	72
601	2.778874	2.778947	2.779019	2.779091	2.779163	2.779235	2.779308	2.779380	2.779452	2.779524	72
602	2.779596	2.779668	2.779741	2.779813	2.779885	2.779957	2.780029	2.780101	2.780173	2.780245	72
603	2.780317	2.780389	2.780461	2.780533	2.780605	2.780677	2.780749	2.780821	2.780893	2.780965	72
604	2.781037	2.781109	2.781181	2.781253	2.781324	2.781396	2.781468	2.781540	2.781612	2.781684	72
605	2.781755	2.781827	2.781899	2.781971	2.782042	2.782114	2.782186	2.782258	2.782329	2.782401	72
606	2.782473	2.782544	2.782616	2.782688	2.782759	2.782831	2.782902	2.782974	2.783046	2.783117	71
607	2.783189	2.783260	2.783332	2.783403	2.783475	2.783546	2.783618	2.783689	2.783761	2.783832	71
608	2.783904	2.783975	2.784046	2.784118	2.784189	2.784261	2.784332	2.784403	2.784475	2.784546	71
609	2.784617	2.784688	2.784760	2.784831	2.784902	2.784974	2.785045	2.785116	2.785187	2.785259	71
610	2.785330	2.785401	2.785472	2.785543	2.785615	2.785686	2.785757	2.785828	2.785899	2.785970	71
611	2.786004	2.786075	2.786146	2.786217	2.786288	2.786359	2.786430	2.786501	2.786572	2.786643	71
612	2.786751	2.786822	2.786893	2.786964	2.787035	2.787106	2.787177	2.787248	2.787319	2.787390	71
613	2.787460	2.787531	2.787602	2.787673	2.787744	2.787815	2.787886	2.787957	2.788028	2.788099	71
614	2.788168	2.788239	2.788310	2.788381	2.788451	2.788522	2.788593	2.788663	2.788734	2.788804	71
615	2.788875	2.788946	2.789016	2.789087	2.789157	2.789228	2.789299	2.789369	2.789440	2.789510	71
616	2.789581	2.789651	2.789722	2.789792	2.789863	2.789933	2.790003	2.790074	2.790144	2.790215	70
617	2.790285	2.790355	2.790426	2.790496	2.790567	2.790637	2.790707	2.790778	2.790848	2.790919	70
618	2.790988	2.791059	2.791129	2.791199	2.791269	2.791340	2.791410	2.791480	2.791550	2.791620	70
619	2.791691	2.791761	2.791831	2.791901	2.791971	2.792041	2.792111	2.792181	2.792252	2.792322	70
620	2.792392	2.792462	2.792532	2.792602	2.792672	2.792742	2.792812	2.792882	2.792952	2.793022	70
621	2.793092	2.793162	2.793231	2.793301	2.793371	2.793441	2.793511	2.793581	2.793651	2.793721	70
622	2.793790	2.793860	2.793930	2.794000	2.794070	2.794139	2.794209	2.794279	2.794349	2.794418	70
623	2.794488	2.794558	2.794627	2.794697	2.794767	2.794836	2.794906	2.794976	2.795045	2.795115	70
624	2.795185	2.795255	2.795324	2.795393	2.795463	2.795532	2.795602	2.795671	2.795741	2.795810	70
625	2.795880	2.795950	2.796019	2.796088	2.796158	2.796227	2.796297	2.796366	2.796436	2.796505	69
626	2.796575	2.796644	2.796713	2.796782	2.796852	2.796921	2.796990	2.797060	2.797129	2.797198	69
627	2.797268	2.797337	2.797406	2.797475	2.797545	2.797614	2.797683	2.797752	2.797821	2.797890	69
628	2.797960	2.798029	2.798098	2.798167	2.798236	2.798305	2.798374	2.798443	2.798512	2.798581	69
629	2.798651	2.798720	2.798789	2.798858	2.798927	2.798996	2.799065	2.799134	2.799203	2.799272	69
630	2.799341	2.799410	2.799479	2.799547	2.799616	2.799685	2.799754	2.799823	2.799892	2.799961	69
631	2.800029	2.800098	2.800167	2.800236	2.800305	2.800373	2.800442	2.800511	2.800580	2.800648	69
632	2.800717	2.800786	2.800854	2.800923	2.800992	2.801060	2.801129	2.801198	2.801267	2.801335	69
633	2.801404	2.801472	2.801541	2.801609	2.801678	2.801747	2.801815	2.801884	2.801952	2.802021	69
634	2.802089	2.802158	2.802226	2.802295	2.802363	2.802432	2.802500	2.802568	2.802637	2.802705	68

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635	2.802774	2.802842	2.802910	2.802979	2.803047	2.803116	2.803184	2.803252	2.803321	2.803389	68
636	2.803457	2.803525	2.803594	2.803662	2.803730	2.803798	2.803867	2.803935	2.804003	2.804071	68
637	2.804139	2.804208	2.804276	2.804344	2.804412	2.804480	2.804548	2.804616	2.804684	2.804753	68
638	2.804821	2.804889	2.804957	2.805025	2.805093	2.805161	2.805229	2.805297	2.805365	2.805433	68
639	2.805501	2.805569	2.805637	2.805705	2.805773	2.805840	2.805908	2.805976	2.806044	2.806112	68
640	2.806180	2.806248	2.806316	2.806384	2.806451	2.806519	2.806587	2.806655	2.806723	2.806790	68
641	2.806858	2.806926	2.806994	2.807061	2.807129	2.807197	2.807264	2.807332	2.807400	2.807467	68
642	2.807535	2.807603	2.807670	2.807738	2.807806	2.807873	2.807941	2.808008	2.808076	2.808143	68
643	2.808211	2.808279	2.808346	2.808414	2.808481	2.808548	2.808616	2.808683	2.808751	2.808818	68
644	2.808886	2.808953	2.809021	2.809088	2.809155	2.809223	2.809290	2.809358	2.809425	2.809492	67
645	2.809560	2.809627	2.809694	2.809762	2.809829	2.809896	2.809963	2.810031	2.810098	2.810165	67
646	2.810235	2.810300	2.810367	2.810434	2.810501	2.810568	2.810636	2.810703	2.810770	2.810837	67
647	2.810904	2.810971	2.811038	2.811106	2.811173	2.811240	2.811307	2.811374	2.811441	2.811508	67
648	2.811575	2.811642	2.811709	2.811776	2.811843	2.811910	2.811977	2.812044	2.812111	2.812178	67
649	2.812245	2.812312	2.812379	2.812445	2.812512	2.812579	2.812646	2.812713	2.812780	2.812846	67
650	2.812913	2.812980	2.813047	2.813114	2.813180	2.813247	2.813314	2.813381	2.813447	2.813514	67
651	2.813581	2.813648	2.813714	2.813781	2.813848	2.813914	2.813980	2.814046	2.814114	2.814181	67
652	2.814248	2.814314	2.814381	2.814447	2.814514	2.814580	2.814647	2.814714	2.814780	2.814847	67
653	2.814913	2.814980	2.815046	2.815112	2.815179	2.815246	2.815312	2.815378	2.815445	2.815511	66
654	2.815578	2.815644	2.815710	2.815777	2.815843	2.815910	2.815976	2.816042	2.816109	2.816175	66
655	2.816241	2.816308	2.816374	2.816440	2.816506	2.816573	2.816639	2.816705	2.816771	2.816838	66
656	2.816904	2.816970	2.817036	2.817102	2.817169	2.817235	2.817301	2.817367	2.817433	2.817499	66
657	2.817565	2.817631	2.817698	2.817764	2.817830	2.817896	2.817962	2.818028	2.818094	2.818160	66
658	2.818226	2.818292	2.818358	2.818424	2.818490	2.818556	2.818622	2.818688	2.818754	2.818819	66
659	2.818885	2.818951	2.819017	2.819083	2.819149	2.819215	2.819281	2.819346	2.819412	2.819478	66
660	2.819544	2.819610	2.819675	2.819741	2.819807	2.819873	2.819939	2.820004	2.820070	2.820136	66
661	2.820201	2.820267	2.820332	2.820398	2.820464	2.820530	2.820595	2.820661	2.820727	2.820792	66
662	2.820858	2.820924	2.820989	2.821055	2.821120	2.821186	2.821251	2.821317	2.821382	2.821448	66
663	2.821513	2.821579	2.821644	2.821710	2.821775	2.821841	2.821906	2.821972	2.822037	2.822103	65
664	2.822168	2.822233	2.822299	2.822364	2.822430	2.822495	2.822560	2.822626	2.822691	2.822756	65
665	2.822822	2.822887	2.822952	2.823017	2.823083	2.823148	2.823213	2.823279	2.823344	2.823409	65
666	2.823474	2.823539	2.823605	2.823670	2.823735	2.823800	2.823865	2.823930	2.823996	2.824061	65
667	2.824126	2.824191	2.824256	2.824321	2.824386	2.824451	2.824516	2.824581	2.824646	2.824711	65
668	2.824776	2.824841	2.824906	2.824971	2.825036	2.825101	2.825166	2.825231	2.825296	2.825361	65
669	2.825426	2.825491	2.825556	2.825620	2.825685	2.825751	2.825815	2.825880	2.825945	2.826010	65
670	2.826075	2.826140	2.826205	2.826269	2.826334	2.826399	2.826464	2.826528	2.826593	2.826658	65
671	2.826722	2.826787	2.826852	2.826917	2.826981	2.827046	2.827111	2.827175	2.827240	2.827305	65
672	2.827369	2.827434	2.827499	2.827563	2.827628	2.827692	2.827757	2.827821	2.827886	2.827950	65
673	2.828015	2.828080	2.828144	2.828209	2.828273	2.828338	2.828402	2.828466	2.828531	2.828595	64
674	2.828660	2.828724	2.828789	2.828853	2.828918	2.828982	2.829046	2.829111	2.829175	2.829239	64
675	2.829304	2.829368	2.829432	2.829497	2.829561	2.829625	2.829690	2.829754	2.829818	2.829882	64
676	2.829947	2.830011	2.830075	2.830139	2.830204	2.830268	2.830332	2.830396	2.830460	2.830524	64
677	2.830589	2.830653	2.830717	2.830781	2.830845	2.830909	2.830973	2.831037	2.831102	2.831166	64
678	2.831230	2.831294	2.831358	2.831422	2.831486	2.831550	2.831614	2.831678	2.831742	2.831806	64
679	2.831870	2.831934	2.831998	2.832062	2.832125	2.832189	2.832253	2.832317	2.832381	2.832445	64
680	2.832509	2.832573	2.832637	2.832700	2.832764	2.832828	2.832892	2.832956	2.833019	2.833083	64
681	2.833147	2.833211	2.833275	2.833338	2.833402	2.833466	2.833530	2.833593	2.833657	2.833721	64
682	2.833784	2.833848	2.833912	2.833975	2.834039	2.834103	2.834166	2.834230	2.834293	2.834357	64
683	2.834421	2.834484	2.834548	2.834611	2.834675	2.834738	2.834802	2.834866	2.834929	2.834993	64
684	2.835056	2.835120	2.835183	2.835246	2.835310	2.835373	2.835437	2.835500	2.835564	2.835627	63
685	2.835691	2.835754	2.835817	2.835881	2.835944	2.836007	2.836071	2.836134	2.836197	2.836261	63
686	2.836324	2.836387	2.836451	2.836514	2.836578	2.836640	2.836704	2.836767	2.836830	2.836893	63
687	2.836957	2.837020	2.837083	2.837146	2.837209	2.837273	2.837336	2.837399	2.837462	2.837525	63
688	2.837588	2.837651	2.837715	2.837778	2.837841	2.837904	2.837967	2.838030	2.838093	2.838156	63
689	2.838219	2.838282	2.838345	2.838408	2.838471	2.838534	2.838597	2.838660	2.838723	2.838786	63

N ^o	0	1	2	3	4	5	6	7	8	9	Diff.
690	2.838849	2.838912	2.838975	2.839038	2.839101	2.839164	2.839227	2.839289	2.839352	2.839415	63
691	2.839478	2.839541	2.839604	2.839667	2.839729	2.839792	2.839855	2.839918	2.839981	2.840043	63
692	2.840106	2.840169	2.840232	2.840294	2.840357	2.840420	2.840482	2.840545	2.840608	2.840671	63
693	2.840733	2.840796	2.840859	2.840921	2.840984	2.841046	2.841109	2.841172	2.841234	2.841297	63
694	2.841359	2.841422	2.841485	2.841547	2.841610	2.841672	2.841735	2.841797	2.841860	2.841922	63
695	2.841985	2.842047	2.842110	2.842172	2.842235	2.842297	2.842360	2.842422	2.842484	2.842547	62
696	2.842609	2.842672	2.842734	2.842796	2.842859	2.842921	2.842984	2.843046	2.843108	2.843170	62
697	2.843233	2.843295	2.843357	2.843420	2.843482	2.843544	2.843606	2.843669	2.843731	2.843793	62
698	2.843855	2.843918	2.843980	2.844042	2.844104	2.844166	2.844229	2.844291	2.844353	2.844415	62
699	2.844477	2.844539	2.844601	2.844663	2.844726	2.844788	2.844851	2.844912	2.844974	2.845036	62
700	2.845098	2.845160	2.845222	2.845284	2.845346	2.845408	2.845470	2.845532	2.845594	2.845656	62
701	2.845718	2.845780	2.845842	2.845904	2.845966	2.846028	2.846090	2.846151	2.846213	2.846275	62
702	2.846337	2.846399	2.846461	2.846523	2.846584	2.846646	2.846708	2.846770	2.846832	2.846893	62
703	2.846955	2.847017	2.847079	2.847141	2.847202	2.847264	2.847326	2.847388	2.847449	2.847511	62
704	2.847573	2.847634	2.847696	2.847758	2.847819	2.847881	2.847943	2.848004	2.848066	2.848127	62
705	2.848189	2.848251	2.848312	2.848374	2.848435	2.848497	2.848559	2.848620	2.848682	2.848743	62
706	2.848805	2.848866	2.848928	2.848989	2.849051	2.849112	2.849174	2.849235	2.849297	2.849358	61
707	2.849419	2.849481	2.849542	2.849604	2.849665	2.849726	2.849788	2.849849	2.849911	2.849972	61
708	2.850033	2.850095	2.850156	2.850217	2.850279	2.850340	2.850401	2.850462	2.850524	2.850585	61
709	2.850646	2.850707	2.850769	2.850830	2.850891	2.850952	2.851014	2.851075	2.851136	2.851197	61
710	2.851258	2.851319	2.851381	2.851442	2.851503	2.851564	2.851625	2.851686	2.851747	2.851808	61
711	2.851870	2.851931	2.851992	2.852053	2.852114	2.852175	2.852236	2.852297	2.852358	2.852419	61
712	2.852480	2.852541	2.852602	2.852663	2.852724	2.852785	2.852846	2.852907	2.852968	2.853029	61
713	2.853089	2.853150	2.853211	2.853272	2.853333	2.853394	2.853455	2.853516	2.853577	2.853637	61
714	2.853698	2.853759	2.853820	2.853881	2.853941	2.854002	2.854063	2.854124	2.854184	2.854245	61
715	2.854306	2.854367	2.854427	2.854488	2.854549	2.854610	2.854670	2.854731	2.854792	2.854852	61
716	2.854913	2.854974	2.855034	2.855095	2.855156	2.855216	2.855277	2.855337	2.855398	2.855459	61
717	2.855519	2.855580	2.855640	2.855701	2.855761	2.855822	2.855882	2.855943	2.856003	2.856064	61
718	2.856124	2.856185	2.856245	2.856306	2.856366	2.856427	2.856487	2.856548	2.856608	2.856668	61
719	2.856729	2.856789	2.856850	2.856910	2.856970	2.857031	2.857091	2.857151	2.857212	2.857272	61
720	2.857332	2.857393	2.857453	2.857513	2.857574	2.857634	2.857694	2.857754	2.857815	2.857875	60
721	2.857935	2.857995	2.858056	2.858116	2.858176	2.858236	2.858296	2.858357	2.858417	2.858477	60
722	2.858537	2.858597	2.858657	2.858718	2.858778	2.858838	2.858898	2.858958	2.859018	2.859078	60
723	2.859138	2.859198	2.859258	2.859318	2.859378	2.859438	2.859499	2.859559	2.859619	2.859679	60
724	2.859739	2.859799	2.859859	2.859919	2.859978	2.860038	2.860098	2.860158	2.860218	2.860278	60
725	2.860338	2.860398	2.860458	2.860518	2.860578	2.860637	2.860697	2.860757	2.860817	2.860877	60
726	2.860937	2.860996	2.861056	2.861116	2.861176	2.861236	2.861295	2.861355	2.861415	2.861475	60
727	2.861534	2.861594	2.861654	2.861714	2.861773	2.861833	2.861893	2.861953	2.862012	2.862072	60
728	2.862131	2.862191	2.862251	2.862310	2.862370	2.862430	2.862489	2.862549	2.862608	2.862668	60
729	2.862727	2.862787	2.862847	2.862906	2.862966	2.863025	2.863085	2.863145	2.863204	2.863263	60
730	2.863323	2.863382	2.863442	2.863501	2.863561	2.863620	2.863680	2.863739	2.863798	2.863858	59
731	2.863917	2.863977	2.864036	2.864096	2.864155	2.864214	2.864274	2.864333	2.864392	2.864452	59
732	2.864511	2.864570	2.864630	2.864689	2.864748	2.864808	2.864867	2.864926	2.864985	2.865045	59
733	2.865104	2.865163	2.865222	2.865282	2.865341	2.865400	2.865459	2.865518	2.865578	2.865637	59
734	2.865696	2.865755	2.865814	2.865873	2.865933	2.865992	2.866051	2.866111	2.866169	2.866228	59
735	2.866287	2.866346	2.866405	2.866465	2.866524	2.866583	2.866642	2.866701	2.866760	2.866819	59
736	2.866878	2.866937	2.866996	2.867055	2.867114	2.867173	2.867232	2.867291	2.867350	2.867409	59
737	2.867467	2.867526	2.867585	2.867644	2.867703	2.867762	2.867821	2.867880	2.867939	2.867997	59
738	2.868056	2.868115	2.868174	2.868233	2.868292	2.868350	2.868409	2.868468	2.868527	2.868586	59
739	2.868644	2.868703	2.868762	2.868821	2.868879	2.868938	2.868997	2.869056	2.869114	2.869173	59
740	2.869232	2.869290	2.869349	2.869408	2.869466	2.869525	2.869584	2.869642	2.869701	2.869760	59
741	2.869818	2.869877	2.869935	2.869994	2.870053	2.870111	2.870170	2.870228	2.870287	2.870345	59
742	2.870404	2.870462	2.870521	2.870579	2.870638	2.870696	2.870755	2.870813	2.870872	2.870930	58
743	2.870989	2.871047	2.871106	2.871164	2.871223	2.871281	2.871339	2.871398	2.871456	2.871515	58
744	2.871573	2.871631	2.871690	2.871748	2.871806	2.871865	2.871923	2.871981	2.872040	2.872098	58

N ^o	0	1	2	3	4	5	6	7	8	9	Diff.
745	2.872156	2.872215	2.872273	2.872331	2.872389	2.872448	2.872506	2.872564	2.872622	2.872681	58
746	2.872739	2.872797	2.872855	2.872913	2.872972	2.873030	2.873088	2.873146	2.873204	2.873262	58
747	2.873321	2.873379	2.873437	2.873495	2.873553	2.873611	2.873669	2.873727	2.873785	2.873843	58
748	2.873922	2.873980	2.874038	2.874096	2.874154	2.874212	2.874270	2.874328	2.874386	2.874444	58
749	2.874482	2.874540	2.874598	2.874656	2.874714	2.874772	2.874830	2.874888	2.874946	2.875003	58
750	2.875061	2.875119	2.875177	2.875235	2.875293	2.875351	2.875409	2.875466	2.875524	2.875582	58
751	2.875640	2.875698	2.875756	2.875813	2.875871	2.875929	2.875987	2.876044	2.876102	2.876160	58
752	2.876218	2.876276	2.876333	2.876391	2.876449	2.876506	2.876564	2.876622	2.876680	2.876737	58
753	2.876795	2.876853	2.876910	2.876968	2.877026	2.877083	2.877141	2.877198	2.877256	2.877314	58
754	2.877371	2.877429	2.877486	2.877544	2.877602	2.877659	2.877717	2.877774	2.877832	2.877889	58
755	2.877943	2.878000	2.878058	2.878116	2.878173	2.878231	2.878289	2.878347	2.878404	2.878462	57
756	2.878522	2.878579	2.878637	2.878694	2.878751	2.878809	2.878866	2.878924	2.878981	2.879038	57
757	2.879096	2.879153	2.879211	2.879268	2.879326	2.879383	2.879440	2.879497	2.879555	2.879612	57
758	2.879669	2.879726	2.879784	2.879841	2.879898	2.879956	2.880013	2.880070	2.880127	2.880185	57
759	2.880242	2.880299	2.880356	2.880413	2.880471	2.880528	2.880585	2.880642	2.880699	2.880756	57
760	2.880814	2.880871	2.880928	2.880985	2.881042	2.881099	2.881156	2.881213	2.881270	2.881328	57
761	2.881385	2.881442	2.881499	2.881556	2.881613	2.881670	2.881727	2.881784	2.881841	2.881898	57
762	2.881955	2.882012	2.882069	2.882126	2.882183	2.882240	2.882297	2.882354	2.882411	2.882468	57
763	2.882524	2.882581	2.882638	2.882695	2.882752	2.882809	2.882866	2.882923	2.882980	2.883036	57
764	2.883093	2.883150	2.883207	2.883264	2.883321	2.883377	2.883434	2.883491	2.883548	2.883605	57
765	2.883661	2.883718	2.883775	2.883832	2.883889	2.883945	2.884002	2.884059	2.884115	2.884172	57
766	2.884229	2.884286	2.884342	2.884399	2.884455	2.884512	2.884569	2.884625	2.884682	2.884739	57
767	2.884795	2.884852	2.884909	2.884965	2.885022	2.885078	2.885135	2.885191	2.885248	2.885305	57
768	2.885361	2.885418	2.885474	2.885531	2.885588	2.885644	2.885700	2.885757	2.885813	2.885870	57
769	2.885926	2.885983	2.886039	2.886096	2.886152	2.886209	2.886265	2.886321	2.886378	2.886434	56
770	2.886490	2.886547	2.886603	2.886660	2.886716	2.886773	2.886829	2.886885	2.886942	2.886998	56
771	2.887054	2.887111	2.887167	2.887223	2.887280	2.887336	2.887392	2.887449	2.887505	2.887561	56
772	2.887617	2.887673	2.887730	2.887786	2.887842	2.887898	2.887955	2.888011	2.888067	2.888123	56
773	2.888179	2.888236	2.888292	2.888348	2.888404	2.888460	2.888516	2.888573	2.888629	2.888685	56
774	2.888741	2.888797	2.888853	2.888909	2.888965	2.889021	2.889077	2.889133	2.889189	2.889246	56
775	2.889302	2.889358	2.889414	2.889470	2.889526	2.889582	2.889638	2.889694	2.889750	2.889806	56
776	2.889862	2.889918	2.889974	2.890030	2.890086	2.890141	2.890197	2.890253	2.890309	2.890365	56
777	2.890421	2.890477	2.890533	2.890589	2.890644	2.890700	2.890755	2.890811	2.890868	2.890924	56
778	2.890980	2.891035	2.891091	2.891147	2.891203	2.891259	2.891314	2.891370	2.891426	2.891482	56
779	2.891537	2.891593	2.891649	2.891705	2.891760	2.891816	2.891872	2.891927	2.891983	2.892039	56
780	2.892095	2.892150	2.892206	2.892262	2.892317	2.892373	2.892428	2.892484	2.892540	2.892595	56
781	2.892651	2.892707	2.892762	2.892818	2.892873	2.892929	2.892985	2.893040	2.893096	2.893151	56
782	2.893207	2.893262	2.893318	2.893373	2.893429	2.893484	2.893540	2.893595	2.893651	2.893706	56
783	2.893762	2.893817	2.893873	2.893928	2.893984	2.894039	2.894094	2.894150	2.894205	2.894261	55
784	2.894316	2.894371	2.894427	2.894482	2.894538	2.894593	2.894648	2.894704	2.894759	2.894814	55
785	2.894870	2.894925	2.894980	2.895036	2.895091	2.895146	2.895201	2.895257	2.895312	2.895367	55
786	2.895422	2.895477	2.895533	2.895588	2.895643	2.895699	2.895754	2.895809	2.895864	2.895919	55
787	2.895973	2.896028	2.896083	2.896140	2.896195	2.896251	2.896306	2.896361	2.896416	2.896471	55
788	2.896526	2.896581	2.896636	2.896691	2.896747	2.896802	2.896857	2.896912	2.896967	2.897022	55
789	2.897077	2.897132	2.897187	2.897242	2.897297	2.897352	2.897407	2.897462	2.897517	2.897572	55
790	2.897627	2.897682	2.897737	2.897792	2.897847	2.897902	2.897957	2.898012	2.898067	2.898122	55
791	2.898176	2.898231	2.898286	2.898341	2.898396	2.898451	2.898506	2.898561	2.898615	2.898670	55
792	2.898725	2.898780	2.898835	2.898890	2.898944	2.898999	2.899054	2.899109	2.899164	2.899218	55
793	2.899273	2.899328	2.899383	2.899437	2.899492	2.899547	2.899602	2.899656	2.899711	2.899766	55
794	2.899820	2.899875	2.899930	2.899985	2.900039	2.900094	2.900149	2.900203	2.900258	2.900312	55
795	2.900367	2.900422	2.900476	2.900531	2.900586	2.900640	2.900695	2.900749	2.900804	2.900858	55
796	2.900913	2.900968	2.901022	2.901077	2.901131	2.901186	2.901240	2.901295	2.901349	2.901404	55
797	2.901458	2.901513	2.901567	2.901622	2.901676	2.901731	2.901785	2.901840	2.901894	2.901948	54
798	2.902003	2.902057	2.902112	2.902166	2.902220	2.902275	2.902329	2.902384	2.902438	2.902492	54
799	2.902547	2.902601	2.902655	2.902710	2.902764	2.902818	2.902873	2.902927	2.902981	2.903036	54

N ^o	0	1	2	3	4	5	6	7	8	9	Diff.
800	2.903000	2.903144	2.903108	2.903253	2.903307	2.903361	2.903416	2.903470	2.903524	2.903578	54
801	2.903632	2.903687	2.903741	2.903795	2.903849	2.903903	2.903958	2.904012	2.904066	2.904120	54
802	2.904174	2.904228	2.904283	2.904337	2.904391	2.904445	2.904499	2.904553	2.904607	2.904661	54
803	2.904715	2.904770	2.904824	2.904878	2.904932	2.904986	2.905040	2.905094	2.905148	2.905202	54
804	2.905256	2.905310	2.905364	2.905418	2.905472	2.905526	2.905580	2.905634	2.905688	2.905742	54
805	2.905796	2.905850	2.905904	2.905958	2.906012	2.906066	2.906119	2.906173	2.906227	2.906281	54
806	2.906335	2.906389	2.906443	2.906497	2.906551	2.906604	2.906658	2.906712	2.906766	2.906820	54
807	2.906873	2.906927	2.906981	2.907035	2.907089	2.907142	2.907196	2.907250	2.907304	2.907358	54
808	2.907411	2.907465	2.907519	2.907573	2.907626	2.907680	2.907734	2.907787	2.907841	2.907895	54
809	2.907948	2.908002	2.908056	2.908109	2.908163	2.908217	2.908270	2.908324	2.908378	2.908431	54
810	2.908485	2.908539	2.908592	2.908646	2.908699	2.908753	2.908807	2.908860	2.908914	2.908967	54
811	2.909021	2.909074	2.909128	2.909181	2.909235	2.909288	2.909342	2.909395	2.909449	2.909502	54
812	2.909556	2.909609	2.909663	2.909716	2.909770	2.909823	2.909877	2.909930	2.909984	2.910037	53
813	2.910090	2.910144	2.910197	2.910251	2.910304	2.910358	2.910411	2.910464	2.910518	2.910571	53
814	2.910624	2.910678	2.910731	2.910784	2.910838	2.910891	2.910944	2.910998	2.911051	2.911104	53
815	2.911158	2.911211	2.911264	2.911317	2.911371	2.911424	2.911477	2.911530	2.911584	2.911637	53
816	2.911690	2.911743	2.911797	2.911850	2.911903	2.911956	2.912009	2.912063	2.912116	2.912169	53
817	2.912222	2.912275	2.912328	2.912381	2.912435	2.912488	2.912541	2.912594	2.912647	2.912700	53
818	2.912753	2.912806	2.912859	2.912912	2.912966	2.913019	2.913072	2.913125	2.913178	2.913231	53
819	2.913284	2.913337	2.913390	2.913443	2.913496	2.913549	2.913602	2.913655	2.913708	2.913761	53
820	2.913814	2.913867	2.913920	2.913973	2.914026	2.914079	2.914131	2.914184	2.914237	2.914290	53
821	2.914343	2.914396	2.914449	2.914502	2.914555	2.914608	2.914661	2.914713	2.914766	2.914819	53
822	2.914872	2.914925	2.914977	2.915030	2.915083	2.915136	2.915189	2.915241	2.915294	2.915347	53
823	2.915400	2.915453	2.915505	2.915558	2.915611	2.915664	2.915716	2.915769	2.915822	2.915874	53
824	2.915927	2.915980	2.916033	2.916085	2.916138	2.916191	2.916243	2.916296	2.916349	2.916401	53
825	2.916454	2.916507	2.916559	2.916612	2.916664	2.916717	2.916770	2.916822	2.916875	2.916927	53
826	2.916980	2.917033	2.917085	2.917138	2.917190	2.917243	2.917295	2.917348	2.917400	2.917453	53
827	2.917505	2.917558	2.917610	2.917663	2.917715	2.917768	2.917820	2.917873	2.917925	2.917978	53
828	2.918030	2.918083	2.918135	2.918188	2.918240	2.918293	2.918345	2.918397	2.918450	2.918502	52
829	2.918554	2.918607	2.918659	2.918712	2.918764	2.918816	2.918869	2.918921	2.918973	2.919026	52
830	2.919078	2.919131	2.919183	2.919235	2.919287	2.919340	2.919392	2.919444	2.919496	2.919549	52
831	2.919601	2.919653	2.919705	2.919758	2.919810	2.919862	2.919914	2.919967	2.920019	2.920071	52
832	2.920123	2.920175	2.920228	2.920280	2.920332	2.920384	2.920436	2.920489	2.920541	2.920593	52
833	2.920645	2.920697	2.920749	2.920801	2.920853	2.920906	2.920958	2.921010	2.921062	2.921114	52
834	2.921166	2.921218	2.921270	2.921322	2.921374	2.921426	2.921478	2.921530	2.921582	2.921634	52
835	2.921686	2.921738	2.921790	2.921842	2.921894	2.921946	2.921998	2.922050	2.922102	2.922154	52
836	2.922206	2.922258	2.922310	2.922362	2.922414	2.922466	2.922518	2.922570	2.922622	2.922674	52
837	2.922725	2.922777	2.922829	2.922881	2.922933	2.922985	2.923037	2.923089	2.923141	2.923193	52
838	2.923244	2.923296	2.923348	2.923399	2.923451	2.923503	2.923555	2.923607	2.923658	2.923710	52
839	2.923762	2.923814	2.923865	2.923917	2.923969	2.924021	2.924072	2.924124	2.924176	2.924228	52
840	2.924279	2.924331	2.924383	2.924434	2.924486	2.924538	2.924589	2.924641	2.924693	2.924744	52
841	2.924796	2.924848	2.924899	2.924951	2.925002	2.925054	2.925106	2.925157	2.925209	2.925260	52
842	2.925312	2.925364	2.925415	2.925467	2.925518	2.925570	2.925621	2.925673	2.925724	2.925776	52
843	2.925828	2.925879	2.925930	2.925982	2.926034	2.926085	2.926137	2.926188	2.926240	2.926291	51
844	2.926342	2.926394	2.926445	2.926497	2.926548	2.926600	2.926651	2.926702	2.926754	2.926805	51
845	2.926857	2.926908	2.926959	2.927011	2.927062	2.927114	2.927165	2.927216	2.927268	2.927319	51
846	2.927370	2.927421	2.927473	2.927524	2.927576	2.927627	2.927678	2.927730	2.927781	2.927832	51
847	2.927883	2.927934	2.927986	2.928037	2.928088	2.928140	2.928191	2.928242	2.928293	2.928344	51
848	2.928396	2.928447	2.928498	2.928549	2.928601	2.928652	2.928703	2.928754	2.928805	2.928856	51
849	2.928908	2.928959	2.929010	2.929061	2.929112	2.929163	2.929214	2.929266	2.929317	2.929368	51
850	2.929419	2.929470	2.929521	2.929572	2.929623	2.929674	2.929725	2.929776	2.929827	2.929878	51
851	2.929930	2.929981	2.930032	2.930083	2.930134	2.930185	2.930236	2.930287	2.930338	2.930389	51
852	2.930440	2.930491	2.930542	2.930593	2.930643	2.930694	2.930745	2.930796	2.930847	2.930898	51
853	2.930949	2.931000	2.931051	2.931102	2.931153	2.931205	2.931256	2.931307	2.931358	2.931409	51
854	2.931460	2.931511	2.931562	2.931613	2.931664	2.931715	2.931766	2.931817	2.931868	2.931919	51

N ^o	0	1	2	3	4	5	6	7	8	9	Diff.
855	2.931966	2.932017	2.932068	2.932118	2.932169	2.932220	2.932271	2.932321	2.932372	2.932423	51
856	2.932474	2.932524	2.932575	2.932626	2.932677	2.932727	2.932778	2.932829	2.932879	2.932930	51
857	2.932981	2.933033	2.933082	2.933133	2.933183	2.933234	2.933285	2.933335	2.933386	2.933437	51
858	2.933487	2.933538	2.933588	2.933639	2.933690	2.933740	2.933791	2.933841	2.933892	2.933943	51
859	2.933992	2.934044	2.934094	2.934145	2.934195	2.934246	2.934296	2.934347	2.934397	2.934448	51
860	2.934498	2.934549	2.934599	2.934650	2.934700	2.934751	2.934801	2.934852	2.934902	2.934953	50
861	2.935003	2.935054	2.935104	2.935154	2.935205	2.935255	2.935306	2.935356	2.935406	2.935457	50
862	2.935507	2.935558	2.935608	2.935658	2.935709	2.935759	2.935809	2.935860	2.935910	2.935960	50
863	2.936011	2.936061	2.936111	2.936162	2.936212	2.936262	2.936313	2.936363	2.936413	2.936463	50
864	2.936514	2.936564	2.936614	2.936664	2.936715	2.936765	2.936815	2.936865	2.936916	2.936966	50
865	2.937016	2.937066	2.937116	2.937167	2.937217	2.937267	2.937317	2.937367	2.937418	2.937468	50
866	2.937518	2.937568	2.937618	2.937668	2.937718	2.937769	2.937819	2.937869	2.937919	2.937969	50
867	2.938019	2.938069	2.938119	2.938169	2.938219	2.938269	2.938319	2.938370	2.938420	2.938470	50
868	2.938520	2.938570	2.938620	2.938670	2.938720	2.938770	2.938820	2.938870	2.938920	2.938970	50
869	2.939020	2.939070	2.939120	2.939170	2.939220	2.939270	2.939319	2.939369	2.939419	2.939469	50
870	2.939519	2.939569	2.939619	2.939669	2.939719	2.939769	2.939819	2.939868	2.939918	2.939968	50
871	2.940018	2.940068	2.940118	2.940168	2.940218	2.940267	2.940317	2.940366	2.940417	2.940467	50
872	2.940516	2.940566	2.940616	2.940666	2.940716	2.940765	2.940815	2.940865	2.940915	2.940964	50
873	2.941014	2.941064	2.941114	2.941163	2.941213	2.941263	2.941313	2.941362	2.941412	2.941462	50
874	2.941511	2.941561	2.941611	2.941660	2.941710	2.941760	2.941809	2.941859	2.941909	2.941958	50
875	2.942008	2.942058	2.942107	2.942157	2.942206	2.942256	2.942306	2.942355	2.942405	2.942454	50
876	2.942504	2.942554	2.942603	2.942653	2.942702	2.942752	2.942801	2.942851	2.942900	2.942950	50
877	2.943000	2.943049	2.943099	2.943148	2.943198	2.943247	2.943297	2.943346	2.943397	2.943445	49
878	2.943494	2.943544	2.943593	2.943643	2.943692	2.943742	2.943791	2.943841	2.943890	2.943939	49
879	2.943989	2.944038	2.944088	2.944137	2.944186	2.944236	2.944285	2.944335	2.944384	2.944433	49
880	2.944483	2.944532	2.944581	2.944631	2.944680	2.944729	2.944779	2.944828	2.944877	2.944927	49
881	2.944976	2.945025	2.945074	2.945124	2.945173	2.945222	2.945272	2.945321	2.945370	2.945419	49
882	2.945469	2.945518	2.945567	2.945616	2.945665	2.945715	2.945764	2.945813	2.945863	2.945911	49
883	2.945961	2.946010	2.946059	2.946108	2.946157	2.946207	2.946256	2.946305	2.946354	2.946403	49
884	2.946452	2.946501	2.946550	2.946600	2.946649	2.946698	2.946747	2.946796	2.946845	2.946894	49
885	2.946943	2.946992	2.947041	2.947090	2.947139	2.947189	2.947238	2.947287	2.947336	2.947385	49
886	2.947434	2.947483	2.947532	2.947581	2.947630	2.947679	2.947728	2.947777	2.947826	2.947875	49
887	2.947924	2.947973	2.948021	2.948070	2.948119	2.948168	2.948217	2.948266	2.948315	2.948364	49
888	2.948413	2.948462	2.948511	2.948560	2.948608	2.948657	2.948707	2.948755	2.948804	2.948853	49
889	2.948902	2.948951	2.948999	2.949048	2.949097	2.949146	2.949195	2.949244	2.949292	2.949341	49
890	2.949390	2.949439	2.949488	2.949537	2.949585	2.949633	2.949682	2.949731	2.949780	2.949829	49
891	2.949978	2.949926	2.949975	2.950023	2.950072	2.950121	2.950170	2.950219	2.950267	2.950316	49
892	2.950365	2.950413	2.950462	2.950511	2.950560	2.950608	2.950657	2.950705	2.950754	2.950803	49
893	2.950859	2.950907	2.950956	2.951004	2.951053	2.951101	2.951150	2.951199	2.951248	2.951297	49
894	2.951337	2.951386	2.951435	2.951483	2.951532	2.951580	2.951629	2.951677	2.951726	2.951774	49
895	2.951823	2.951872	2.951920	2.951969	2.952017	2.952066	2.952114	2.952163	2.952211	2.952259	48
896	2.952328	2.952376	2.952425	2.952473	2.952522	2.952570	2.952619	2.952667	2.952716	2.952764	48
897	2.952792	2.952841	2.952889	2.952938	2.952986	2.953034	2.953083	2.953131	2.953180	2.953228	48
898	2.953276	2.953325	2.953373	2.953421	2.953470	2.953518	2.953566	2.953615	2.953663	2.953711	48
899	2.953760	2.953808	2.953856	2.953905	2.953953	2.954001	2.954049	2.954098	2.954146	2.954194	48
900	2.954242	2.954291	2.954339	2.954387	2.954435	2.954484	2.954532	2.954580	2.954628	2.954677	48
901	2.954725	2.954773	2.954821	2.954869	2.954918	2.954966	2.955014	2.955062	2.955110	2.955158	48
902	2.955206	2.955255	2.955303	2.955351	2.955399	2.955447	2.955495	2.955543	2.955591	2.955640	48
903	2.955688	2.955736	2.955784	2.955832	2.955880	2.955928	2.955976	2.956024	2.956072	2.956120	48
904	2.956168	2.956216	2.956264	2.956312	2.956360	2.956409	2.956457	2.956505	2.956553	2.956601	48
905	2.956649	2.956697	2.956744	2.956792	2.956840	2.956888	2.956936	2.956984	2.957032	2.957080	48
906	2.957128	2.957176	2.957224	2.957272	2.957320	2.957368	2.957416	2.957464	2.957511	2.957559	48
907	2.957607	2.957655	2.957703	2.957751	2.957799	2.957847	2.957894	2.957942	2.957990	2.958038	48
908	2.958086	2.958134	2.958181	2.958229	2.958277	2.958325	2.958373	2.958421	2.958468	2.958516	48
909	2.958564	2.958612	2.958659	2.958707	2.958755	2.958803	2.958850	2.958898	2.958946	2.958994	48

N	0	1	2	3	4	5	6	7	8	9	Diff.
910	2.959041	2.959089	2.959137	2.959184	2.959232	2.959280	2.959328	2.959375	2.959422	2.959471	48
911	2.959518	2.959566	2.959614	2.959661	2.959709	2.959757	2.959804	2.959852	2.959900	2.959947	48
912	2.959995	2.960042	2.960089	2.960138	2.960185	2.960233	2.960280	2.960328	2.960376	2.960423	48
913	2.960471	2.960518	2.960566	2.960613	2.960661	2.960708	2.960756	2.960804	2.960851	2.960899	48
914	2.960946	2.960994	2.961041	2.961089	2.961136	2.961184	2.961231	2.961279	2.961326	2.961374	47
915	2.961421	2.961468	2.961516	2.961563	2.961611	2.961658	2.961706	2.961753	2.961801	2.961848	47
916	2.961895	2.961943	2.961990	2.962038	2.962085	2.962132	2.962180	2.962227	2.962275	2.962322	47
917	2.962369	2.962417	2.962464	2.962511	2.962559	2.962606	2.962653	2.962701	2.962748	2.962795	47
918	2.962843	2.962890	2.962937	2.962985	2.963032	2.963079	2.963126	2.963174	2.963221	2.963268	47
919	2.963315	2.963363	2.963410	2.963457	2.963504	2.963552	2.963599	2.963646	2.963693	2.963741	47
920	2.963788	2.963835	2.963882	2.963929	2.963977	2.964024	2.964071	2.964118	2.964165	2.964212	47
921	2.964260	2.964307	2.964354	2.964401	2.964448	2.964495	2.964542	2.964589	2.964636	2.964683	47
922	2.964731	2.964778	2.964825	2.964872	2.964919	2.964966	2.965013	2.965060	2.965108	2.965155	47
923	2.965202	2.965249	2.965296	2.965343	2.965390	2.965437	2.965484	2.965531	2.965578	2.965625	47
924	2.965672	2.965719	2.965766	2.965813	2.965860	2.965907	2.965954	2.966001	2.966048	2.966095	47
925	2.966142	2.966189	2.966236	2.966283	2.966329	2.966376	2.966423	2.966470	2.966517	2.966564	47
926	2.966611	2.966658	2.966705	2.966752	2.966798	2.966845	2.966892	2.966939	2.966986	2.967033	47
927	2.967080	2.967127	2.967173	2.967220	2.967267	2.967314	2.967361	2.967408	2.967454	2.967501	47
928	2.967548	2.967595	2.967642	2.967688	2.967735	2.967782	2.967829	2.967875	2.967922	2.967969	47
929	2.968016	2.968062	2.968107	2.968156	2.968203	2.968249	2.968296	2.968343	2.968389	2.968436	47
930	2.968483	2.968530	2.968576	2.968623	2.968670	2.968716	2.968763	2.968810	2.968856	2.968903	47
931	2.968950	2.968996	2.969042	2.969089	2.969136	2.969183	2.969229	2.969276	2.969323	2.969369	47
932	2.969416	2.969462	2.969509	2.969556	2.969602	2.969649	2.969696	2.969742	2.969788	2.969835	47
933	2.969882	2.969928	2.969975	2.970021	2.970068	2.970114	2.970161	2.970207	2.970254	2.970300	47
934	2.970347	2.970393	2.970440	2.970486	2.970533	2.970579	2.970626	2.970672	2.970719	2.970765	46
935	2.970812	2.970858	2.970904	2.970951	2.970997	2.971044	2.971090	2.971137	2.971183	2.971224	46
936	2.971276	2.971322	2.971369	2.971415	2.971461	2.971508	2.971554	2.971600	2.971647	2.971693	46
937	2.971740	2.971786	2.971832	2.971879	2.971925	2.971971	2.972018	2.972064	2.972110	2.972156	46
938	2.972203	2.972249	2.972295	2.972342	2.972388	2.972434	2.972480	2.972527	2.972573	2.972619	46
939	2.972666	2.972712	2.972758	2.972804	2.972851	2.972897	2.972943	2.972989	2.973035	2.973082	46
940	2.973128	2.973174	2.973220	2.973266	2.973313	2.973359	2.973405	2.973451	2.973497	2.973543	46
941	2.973590	2.973636	2.973682	2.973728	2.973774	2.973820	2.973866	2.973913	2.973959	2.974005	46
942	2.974051	2.974097	2.974143	2.974189	2.974235	2.974281	2.974327	2.974373	2.974420	2.974466	46
943	2.974512	2.974558	2.974604	2.974650	2.974696	2.974742	2.974788	2.974834	2.974880	2.974926	46
944	2.974972	2.975018	2.975064	2.975110	2.975156	2.975202	2.975248	2.975294	2.975340	2.975386	46
945	2.975432	2.975478	2.975524	2.975570	2.975616	2.975661	2.975707	2.975753	2.975799	2.975845	46
946	2.975890	2.975937	2.975983	2.976029	2.976075	2.976121	2.976166	2.976212	2.976258	2.976304	46
947	2.976350	2.976396	2.976442	2.976487	2.976533	2.976579	2.976625	2.976671	2.976717	2.976762	46
948	2.976808	2.976854	2.976900	2.976946	2.976991	2.977037	2.977083	2.977129	2.977175	2.977220	46
949	2.977266	2.977312	2.977358	2.977403	2.977449	2.977495	2.977541	2.977586	2.977632	2.977678	46
950	2.977724	2.977769	2.977815	2.977861	2.977906	2.977952	2.977998	2.978043	2.978089	2.978135	46
951	2.978180	2.978226	2.978272	2.978317	2.978363	2.978409	2.978454	2.978500	2.978546	2.978591	46
952	2.978637	2.978683	2.978728	2.978774	2.978819	2.978865	2.978911	2.978956	2.979002	2.979047	46
953	2.979093	2.979138	2.979184	2.979230	2.979275	2.979321	2.979366	2.979412	2.979457	2.979503	46
954	2.979548	2.979594	2.979639	2.979685	2.979730	2.979776	2.979821	2.979867	2.979912	2.979958	46
955	2.980003	2.980049	2.980094	2.980140	2.980185	2.980231	2.980276	2.980322	2.980367	2.980412	45
956	2.980458	2.980503	2.980549	2.980594	2.980640	2.980685	2.980730	2.980776	2.980821	2.980867	45
957	2.980912	2.980957	2.981003	2.981048	2.981093	2.981139	2.981184	2.981229	2.981275	2.981320	45
958	2.981365	2.981411	2.981456	2.981501	2.981547	2.981592	2.981637	2.981683	2.981728	2.981773	45
959	2.981819	2.981864	2.981909	2.981954	2.982000	2.982045	2.982090	2.982135	2.982181	2.982226	45
960	2.982271	2.982316	2.982362	2.982407	2.982452	2.982497	2.982543	2.982588	2.982633	2.982678	45
961	2.982723	2.982769	2.982814	2.982859	2.982904	2.982949	2.982994	2.983040	2.983085	2.983130	45
962	2.983175	2.983220	2.983265	2.983310	2.983356	2.983401	2.983446	2.983491	2.983536	2.983581	45
963	2.983626	2.983671	2.983716	2.983762	2.983807	2.983852	2.983897	2.983942	2.983987	2.984032	45
964	2.984077	2.984122	2.984167	2.984212	2.984257	2.984302	2.984347	2.984392	2.984437	2.984482	45

Nº	0	1	2	3	4	5	6	7	8	9	Diff.
965	2.984527	2.984572	2.984617	2.984662	2.984707	2.984752	2.984797	2.984842	2.984887	2.984932	45
966	2.984977	2.985022	2.985067	2.985112	2.985157	2.985202	2.985247	2.985292	2.985337	2.985382	45
967	2.985426	2.985471	2.985516	2.985561	2.985606	2.985651	2.985696	2.985741	2.985786	2.985831	45
968	2.985875	2.985920	2.985965	2.986010	2.986055	2.986100	2.986144	2.986189	2.986234	2.986279	45
969	2.986324	2.986369	2.986413	2.986458	2.986503	2.986548	2.986593	2.986637	2.986682	2.986727	45
970	2.986772	2.986816	2.986861	2.986906	2.986951	2.986995	2.987040	2.987085	2.987130	2.987174	45
971	2.987219	2.987264	2.987309	2.987353	2.987398	2.987443	2.987487	2.987532	2.987577	2.987622	45
972	2.987666	2.987711	2.987756	2.987800	2.987845	2.987890	2.987934	2.987979	2.988024	2.988068	45
973	2.988113	2.988157	2.988202	2.988247	2.988291	2.988336	2.988381	2.988425	2.988470	2.988514	45
974	2.988559	2.988603	2.988648	2.988693	2.988737	2.988782	2.988826	2.988871	2.988915	2.988960	45
975	2.989005	2.989049	2.989094	2.989138	2.989183	2.989227	2.989272	2.989316	2.989361	2.989405	45
976	2.989450	2.989494	2.989539	2.989583	2.989628	2.989672	2.989717	2.989761	2.989806	2.989850	44
977	2.989895	2.989939	2.989983	2.990028	2.990072	2.990117	2.990161	2.990206	2.990250	2.990294	44
978	2.990339	2.990383	2.990428	2.990472	2.990516	2.990561	2.990605	2.990650	2.990694	2.990738	44
979	2.990783	2.990827	2.990871	2.990916	2.990960	2.991004	2.991049	2.991093	2.991137	2.991182	44
980	2.991226	2.991270	2.991315	2.991359	2.991403	2.991448	2.991492	2.991536	2.991580	2.991625	44
981	2.991669	2.991713	2.991757	2.991802	2.991846	2.991890	2.991934	2.991979	2.992023	2.992067	44
982	2.992111	2.992156	2.992200	2.992244	2.992288	2.992333	2.992377	2.992421	2.992465	2.992509	44
983	2.992553	2.992598	2.992642	2.992686	2.992730	2.992774	2.992818	2.992863	2.992907	2.992951	44
984	2.992995	2.993039	2.993083	2.993127	2.993172	2.993216	2.993260	2.993304	2.993348	2.993392	44
985	2.993436	2.993480	2.993524	2.993568	2.993613	2.993657	2.993701	2.993745	2.993789	2.993833	44
986	2.993877	2.993921	2.993965	2.994009	2.994053	2.994097	2.994141	2.994185	2.994229	2.994273	44
987	2.994317	2.994361	2.994405	2.994449	2.994493	2.994537	2.994581	2.994625	2.994669	2.994713	44
988	2.994757	2.994801	2.994845	2.994889	2.994933	2.994977	2.995021	2.995064	2.995108	2.995152	44
989	2.995196	2.995240	2.995284	2.995328	2.995372	2.995416	2.995460	2.995504	2.995547	2.995591	44
990	2.995635	2.995679	2.995723	2.995767	2.995811	2.995854	2.995898	2.995942	2.995986	2.996030	44
991	2.996074	2.996117	2.996161	2.996205	2.996249	2.996293	2.996336	2.996380	2.996424	2.996468	44
992	2.996512	2.996555	2.996599	2.996643	2.996687	2.996730	2.996774	2.996818	2.996862	2.996905	44
993	2.996949	2.996993	2.997037	2.997080	2.997124	2.997168	2.997212	2.997255	2.997299	2.997343	44
994	2.997386	2.997430	2.997474	2.997517	2.997561	2.997605	2.997648	2.997692	2.997736	2.997779	44
995	2.997823	2.997867	2.997910	2.997954	2.997998	2.998041	2.998085	2.998128	2.998172	2.998216	44
996	2.998259	2.998303	2.998346	2.998390	2.998434	2.998477	2.998521	2.998564	2.998608	2.998652	44
997	2.998695	2.998739	2.998782	2.998826	2.998869	2.998913	2.998956	2.999000	2.999043	2.999087	44
998	2.999130	2.999174	2.999218	2.999261	2.999305	2.999348	2.999392	2.999435	2.999478	2.999522	44
999	2.999565	2.999609	2.999652	2.999696	2.999739	2.999783	2.999826	2.999870	2.999913	2.999957	43

Min.	o Degree				Min.
	Sine	Sine Comp.	Tang.	Tang. Com.	
	0.0000000	10.0000000	0.0000000	Infinite	60
1	6.4637261	9.9999999	6.4637261	13.5362739	59
2	6.7647561	9.9999999	6.7647561	13.2352438	58
3	6.9408473	9.9999999	6.9408473	13.0591525	57
4	7.0657860	9.9999997	7.0657860	12.9342137	56
5	7.1626960	9.9999996	7.1626960	12.8373036	55
6	7.2418771	9.9999993	7.2418771	12.7581222	54
7	7.3088239	9.9999991	7.3088239	12.6911752	53
8	7.3668157	9.9999988	7.3668157	12.6331512	52
9	7.4179681	9.9999985	7.4179681	12.5820304	51
10	7.4637255	9.9999982	7.4637255	12.5362727	50
11	7.5051181	9.9999978	7.5051181	12.4948797	49
12	7.5429065	9.9999974	7.5429065	12.4570909	48
13	7.5776684	9.9999969	7.5776684	12.4222844	47
14	7.6098530	9.9999964	7.6098530	12.3901434	46
15	7.6398160	9.9999959	7.6398160	12.3601799	45
16	7.6678445	9.9999953	7.6678445	12.3321508	44
17	7.6941733	9.9999947	7.6941733	12.3058214	43
18	7.7189966	9.9999940	7.7189966	12.2799974	42
19	7.7424775	9.9999934	7.7424775	12.2551591	41
20	7.7647537	9.9999927	7.7647537	12.2323902	40
21	7.7859217	9.9999919	7.7859217	12.2104923	39
22	7.8061458	9.9999911	7.8061458	12.1938453	38
23	7.8254507	9.9999903	7.8254507	12.1745396	37
24	7.8439338	9.9999894	7.8439338	12.1560536	36
25	7.8616923	9.9999885	7.8616923	12.1382362	35
26	7.8786537	9.9999876	7.8786537	12.1212923	34
27	7.8956854	9.9999866	7.8956854	12.1049012	33
28	7.9108793	9.9999856	7.9108793	12.0891062	32
29	7.9261190	9.9999845	7.9261190	12.0738636	31
30	7.9408419	9.9999835	7.9408419	12.0591416	30
31	7.9550819	9.9999823	7.9550819	12.0449004	29
32	7.9688698	9.9999812	7.9688698	12.0311124	28
33	7.9822334	9.9999800	7.9822334	12.0177466	27
34	7.9951980	9.9999788	7.9951980	12.0047808	26
35	8.0077867	9.9999775	8.0077867	11.9911908	25
36	8.0200207	9.9999762	8.0200207	11.9799555	24
37	8.0319195	9.9999748	8.0319195	11.9688271	23
38	8.0435009	9.9999735	8.0435009	11.9567262	22
39	8.0547814	9.9999721	8.0547814	11.9445196	21
40	8.0657763	9.9999706	8.0657763	11.9321943	20
41	8.0764997	9.9999691	8.0764997	11.9234694	19
42	8.0869646	9.9999676	8.0869646	11.9130030	18
43	8.0971832	9.9999660	8.0971832	11.9027828	17
44	8.1071669	9.9999644	8.1071669	11.8927975	16
45	8.1169262	9.9999628	8.1169262	11.8830266	15
46	8.1264710	9.9999611	8.1264710	11.8734901	14
47	8.1358104	9.9999594	8.1358104	11.8641913	13
48	8.1449532	9.9999577	8.1449532	11.8550044	12
49	8.1539275	9.9999559	8.1539275	11.8460484	11
50	8.1626808	9.9999541	8.1626808	11.8372733	10
51	8.1712804	9.9999522	8.1712804	11.8286718	9
52	8.1797129	9.9999503	8.1797129	11.8202374	8
53	8.1879848	9.9999484	8.1879848	11.8119636	7
54	8.1961020	9.9999464	8.1961020	11.8038444	6
55	8.2040703	9.9999444	8.2040703	11.7958741	5
56	8.2118949	9.9999424	8.2118949	11.7880592	4
57	8.2195811	9.9999403	8.2195811	11.7803574	3
58	8.2271335	9.9999382	8.2271335	11.7728047	2
59	8.2345568	9.9999360	8.2345568	11.7653792	1
60	8.2418553	9.9999338	8.2418553	11.7580785	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

89 Degrees

Min.	1 Degree				Min.
	Sine	Sine Comp.	Tang.	Tan. Comp.	
0	8.2418553	9.9999338	8.2419215	11.7580785	60
1	8.2490332	9.9999316	8.2491015	11.7508985	59
2	8.2560943	9.9999294	8.2561649	11.7438351	58
3	8.2630424	9.9999271	8.2631153	11.7368847	57
4	8.2698810	9.9999247	8.2699563	11.7300437	56
5	8.2766936	9.9999224	8.2767691	11.7233088	55
6	8.2834834	9.9999200	8.2835634	11.7166766	54
7	8.2899707	9.9999175	8.2899559	11.7101441	53
8	8.2962634	9.9999150	8.2962917	11.7037083	52
9	8.3024500	9.9999125	8.3024633	11.6973665	51
10	8.3085791	9.9999100	8.3085824	11.6911158	50
11	8.3146536	9.9999074	8.3146562	11.6849538	49
12	8.3206690	9.9999047	8.3206721	11.6788779	48
13	8.3266263	9.9999021	8.3266294	11.6728857	47
14	8.3325243	9.9998994	8.3325274	11.6669751	46
15	8.3383729	9.9998966	8.3383760	11.6611437	45
16	8.3441805	9.9998939	8.3441836	11.6553905	44
17	8.3500480	9.9998911	8.3500511	11.6497105	43
18	8.3558783	9.9998882	8.3558814	11.6441047	42
19	8.3616730	9.9998853	8.3616761	11.6385703	41
20	8.3674369	9.9998824	8.3674400	11.6331055	40
21	8.3731710	9.9998794	8.3731741	11.6277039	39
22	8.3788798	9.9998764	8.3788829	11.6223777	38
23	8.3845620	9.9998734	8.3845651	11.6171143	37
24	8.3896222	9.9998703	8.3896253	11.6119082	36
25	8.3939308	9.9998672	8.3939339	11.6067664	35
26	8.3981793	9.9998641	8.3981824	11.6016884	34
27	8.4023700	9.9998609	8.4023731	11.5966619	33
28	8.4065116	9.9998577	8.4065147	11.5916963	32
29	8.4106076	9.9998544	8.4106107	11.5867868	31
30	8.4147910	9.9998512	8.4147941	11.5819321	30
31	8.4227168	9.9998478	8.4227199	11.5771310	29
32	8.4274261	9.9998445	8.4274292	11.5723824	28
33	8.4321551	9.9998411	8.4321582	11.5676850	27
34	8.4367999	9.9998376	8.4368030	11.5630378	26
35	8.4413944	9.9998342	8.4413975	11.5584397	25
36	8.4459490	9.9998306	8.4459521	11.5538897	24
37	8.4504402	9.9998271	8.4504433	11.5493869	23
38	8.4548934	9.9998235	8.4548965	11.5449301	22
39	8.4593013	9.9998199	8.4593044	11.5405186	21
40	8.4636649	9.9998162	8.4636680	11.5361514	20
41	8.4679750	9.9998125	8.4679781	11.5318279	19
42	8.4722266	9.9998088	8.4722297	11.5275462	18
43	8.4764284	9.9998050	8.4764315	11.5233067	17
44	8.4805932	9.9998012	8.4805963	11.5191086	16
45	8.4848479	9.9997974	8.4848510	11.5149495	15
46	8.4889632	9.9997935	8.4889663	11.5108304	14
47	8.4930398	9.9997896	8.4930429	11.5067498	13
48	8.4970786	9.9997856	8.4970817	11.5027072	12
49	8.5010798	9.9997817	8.5010829	11.4987018	11
50	8.5050447	9.9997776	8.5050478	11.4947329	10
51	8.5089736	9.9997736	8.5089767	11.4907999	9
52	8.5128673	9.9997695	8.5128704	11.4869022	8
53	8.5167204	9.9997653	8.5167235	11.4830387	7
54	8.5205514	9.9997612	8.5205545	11.4792098	6
55	8.5243430	9.9997570	8.5243461	11.4754149	5
56	8.5281017	9.9997527	8.5281048	11.4716510	4
57	8.5318281	9.9997484	8.5318312	11.4679124	3
58	8.5355283	9.9997441	8.5355314	11.4642213	2
59	8.5391866	9.9997398	8.5391897	11.4605534	1
60	8.5428192	9.9997354	8.5428223	11.4569162	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

88 Degrees

Min.	2 Degrees.				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	8.5428192	9.9997354	8.5430838	11.4569162	60
1	8.5464218	9.9997309	8.5466899	11.4533091	59
2	8.5499948	9.9997265	8.5505603	11.4497317	58
3	8.5535380	9.9997220	8.5538165	11.4461834	57
4	8.5570536	9.9997174	8.5573621	11.4426638	56
5	8.5605404	9.9997128	8.5608276	11.4391724	55
6	8.5639994	9.9997082	8.5642912	11.4357088	54
7	8.5674310	9.9997036	8.5677275	11.4322725	53
8	8.5708357	9.9996989	8.5711368	11.4288632	52
9	8.5742139	9.9996942	8.5745197	11.4254803	51
10	8.5775660	9.9996894	8.5778766	11.4221234	50
11	8.5809923	9.9996846	8.5812077	11.4187923	49
12	8.5844193	9.9996798	8.5845136	11.4154864	48
13	8.5878494	9.9996749	8.5879451	11.4122055	47
14	8.5912739	9.9996700	8.5915059	11.4089491	46
15	8.5939483	9.9996650	8.5942832	11.4057168	45
16	8.5971517	9.9996601	8.5974917	11.4025083	44
17	8.6003317	9.9996550	8.6007677	11.3993233	43
18	8.6034886	9.9996500	8.6038386	11.3961614	42
19	8.6066226	9.9996449	8.6069777	11.3930223	41
20	8.6097341	9.9996398	8.6100943	11.3899057	40
21	8.6128235	9.9996346	8.6131889	11.3868111	39
22	8.6158910	9.9996294	8.6162616	11.3837384	38
23	8.6189369	9.9996242	8.6193127	11.3806873	37
24	8.6219616	9.9996189	8.6223427	11.3776573	36
25	8.6249653	9.9996136	8.6253518	11.3746482	35
26	8.6279484	9.9996082	8.6283402	11.3716598	34
27	8.6309111	9.9996028	8.6313083	11.3686917	33
28	8.6338537	9.9995974	8.6342563	11.3657437	32
29	8.6367764	9.9995919	8.6371845	11.3628155	31
30	8.6396796	9.9995865	8.6400931	11.3599059	30
31	8.6425634	9.9995809	8.6429825	11.3570175	29
32	8.6454282	9.9995753	8.6458528	11.3541472	28
33	8.6482742	9.9995697	8.6487044	11.3512946	27
34	8.6511016	9.9995641	8.6515375	11.3484625	26
35	8.6539107	9.9995584	8.6543522	11.3456487	25
36	8.6567017	9.9995527	8.6571490	11.3428510	24
37	8.6594748	9.9995469	8.6599279	11.3400721	23
38	8.6622303	9.9995411	8.6626891	11.3373109	22
39	8.6649684	9.9995353	8.6654331	11.3345669	21
40	8.6676893	9.9995297	8.6681598	11.3318402	20
41	8.6703932	9.9995240	8.6708697	11.3291303	19
42	8.6730804	9.9995176	8.6735628	11.3264372	18
43	8.6757510	9.9995116	8.6762393	11.3237607	17
44	8.6784052	9.9995056	8.6788996	11.3211004	16
45	8.6810433	9.9994996	8.6815437	11.3184503	15
46	8.6836654	9.9994935	8.6841710	11.3158281	14
47	8.6862718	9.9994874	8.6867844	11.3132256	13
48	8.6888625	9.9994812	8.6893831	11.3106472	12
49	8.6914379	9.9994750	8.6919629	11.3080931	11
50	8.6939985	9.9994688	8.6945292	11.3055610	10
51	8.6965431	9.9994625	8.6970836	11.3030494	9
52	8.6990734	9.9994562	8.6996172	11.3005582	8
53	8.7015889	9.9994498	8.7021390	11.2980860	7
54	8.7040899	9.9994435	8.7046461	11.2956335	6
55	8.7065766	9.9994372	8.7071395	11.2932005	5
56	8.7090499	9.9994306	8.7096181	11.2907815	4
57	8.7115075	9.9994241	8.7120884	11.2883816	3
58	8.7139520	9.9994176	8.7145345	11.2859955	2
59	8.7163829	9.9994110	8.7169719	11.2836281	1
60	8.7188002	9.9994044	8.7193598	11.2812802	0
Sine Comp.	Sine	Tang. Comp.	Tang.		

87 Degrees

Min.	3 Degrees.				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	8.7188002	9.9994044	8.7193598	11.2812802	60
1	8.7212940	9.9993978	8.7218563	11.2789377	59
2	8.7237946	9.9993911	8.7243293	11.2765965	58
3	8.7262971	9.9993844	8.7268057	11.2742573	57
4	8.7288336	9.9993776	8.7293589	11.2719141	56
5	8.7308382	9.9993708	8.7313174	11.2695826	55
6	8.7330272	9.9993640	8.7336531	11.2672369	54
7	8.7353535	9.9993572	8.7359964	11.2648905	53
8	8.7376677	9.9993503	8.7383172	11.2625628	52
9	8.7399698	9.9993433	8.7406258	11.2599342	51
10	8.7422586	9.9993364	8.7429222	11.2570778	50
11	8.7445360	9.9993293	8.7452067	11.2547933	49
12	8.7468019	9.9993223	8.7474792	11.2525208	48
13	8.7490553	9.9993152	8.7497400	11.2502600	47
14	8.7512973	9.9993081	8.7519892	11.2480128	46
15	8.7535278	9.9993009	8.7542269	11.2457731	45
16	8.7557469	9.9992938	8.7564531	11.2435490	44
17	8.7579540	9.9992865	8.7586681	11.2413393	43
18	8.7601512	9.9992793	8.7608719	11.2391281	42
19	8.7623386	9.9992720	8.7630647	11.2369353	41
20	8.7645111	9.9992646	8.7652465	11.2347535	40
21	8.7666747	9.9992572	8.7674175	11.2325825	39
22	8.7688219	9.9992498	8.7695792	11.2304223	38
23	8.7709609	9.9992424	8.7717276	11.2282720	37
24	8.7730914	9.9992349	8.7738855	11.2261333	36
25	8.7752220	9.9992274	8.7759952	11.2240048	35
26	8.7773334	9.9992198	8.7781136	11.2218864	34
27	8.7794334	9.9992122	8.7802218	11.2197782	33
28	8.7815244	9.9992046	8.7823199	11.2176801	32
29	8.7836048	9.9991969	8.7844177	11.2155921	31
30	8.7856753	9.9991892	8.7865061	11.2135139	30
31	8.7877359	9.9991815	8.7885854	11.2114456	29
32	8.7897867	9.9991737	8.7906613	11.2093876	28
33	8.7918274	9.9991659	8.7926302	11.2073385	27
34	8.7938584	9.9991580	8.7947014	11.2052985	26
35	8.7958814	9.9991501	8.7967313	11.2032687	25
36	8.7978941	9.9991422	8.7987519	11.2012481	24
37	8.7998974	9.9991342	8.8007632	11.1992368	23
38	8.8018913	9.9991262	8.8027653	11.1972347	22
39	8.8038764	9.9991182	8.8047583	11.1952417	21
40	8.8058523	9.9991101	8.8067422	11.1932578	20
41	8.8078192	9.9991020	8.8087172	11.1912828	19
42	8.8097777	9.9990938	8.8106834	11.1893166	18
43	8.8117264	9.9990856	8.8126407	11.1873593	17
44	8.8136668	9.9990774	8.8145894	11.1854106	16
45	8.8155985	9.9990691	8.8165294	11.1834706	15
46	8.8175215	9.9990605	8.8184608	11.1815392	14
47	8.8194363	9.9990521	8.8203838	11.1796162	13
48	8.8213423	9.9990435	8.8222984	11.1777016	12
49	8.8232404	9.9990357	8.8242046	11.1757954	11
50	8.8251299	9.9990273	8.8261026	11.1738974	10
51	8.8270112	9.9990188	8.8279968	11.1720076	9
52	8.8288844	9.9990103	8.8298871	11.1701259	8
53	8.8307493	9.9990017	8.8317748	11.1682522	7
54	8.8326066	9.9989931	8.8336534	11.1663866	6
55	8.8344557	9.9989845	8.8355212	11.1645288	5
56	8.8362969	9.9989758	8.8373211	11.1626789	4
57	8.8381304	9.9989671	8.8391633	11.1608367	3
58	8.8399561	9.9989584	8.8409977	11.1590023	2
59	8.8417741	9.9989496	8.8428245	11.1571755	1
60	8.8435843	9.9989408	8.8446437	11.1553593	0
Sine Comp.	Sine	Tang. Comp.	Tang.		

86 Degrees

4 Degrees.				
Min.	Sine	Sine Comp.	Tang.	Tang. Comp.
0	8.8435845	9.9989408	8.8446347	11.1553563
1	8.8435874	9.9989319	8.8446554	11.1553446
2	8.8435907	9.9989235	8.8446797	11.1553320
3	8.8435940	9.9989141	8.8447066	11.1553199
4	8.8435975	9.9989052	8.8447361	11.1553079
5	8.8436010	9.9988962	8.8447683	11.1552959
6	8.8436045	9.9988871	8.8448039	11.1552839
7	8.8436080	9.9988780	8.8448417	11.1552719
8	8.8436115	9.9988689	8.8448811	11.1552600
9	8.8436150	9.9988598	8.8449221	11.1552480
10	8.8436185	9.9988506	8.8449647	11.1552361
11	8.8436220	9.9988414	8.8450089	11.1552242
12	8.8436255	9.9988322	8.8450546	11.1552123
13	8.8436290	9.9988231	8.8451019	11.1552004
14	8.8436325	9.9988139	8.8451506	11.1551885
15	8.8436360	9.9988047	8.8452006	11.1551766
16	8.8436395	9.9987956	8.8452519	11.1551647
17	8.8436430	9.9987864	8.8453043	11.1551528
18	8.8436465	9.9987773	8.8453578	11.1551409
19	8.8436500	9.9987682	8.8454124	11.1551290
20	8.8436535	9.9987591	8.8454681	11.1551171
21	8.8436570	9.9987500	8.8455248	11.1551052
22	8.8436605	9.9987409	8.8455826	11.1550933
23	8.8436640	9.9987318	8.8456414	11.1550814
24	8.8436675	9.9987227	8.8457012	11.1550695
25	8.8436710	9.9987136	8.8457620	11.1550576
26	8.8436745	9.9987045	8.8458238	11.1550457
27	8.8436780	9.9986954	8.8458866	11.1550338
28	8.8436815	9.9986863	8.8459504	11.1550219
29	8.8436850	9.9986772	8.8460152	11.1550100
30	8.8436885	9.9986681	8.8460810	11.1549981
31	8.8436920	9.9986590	8.8461478	11.1549862
32	8.8436955	9.9986499	8.8462156	11.1549743
33	8.8436990	9.9986408	8.8462844	11.1549624
34	8.8437025	9.9986317	8.8463542	11.1549505
35	8.8437060	9.9986226	8.8464250	11.1549386
36	8.8437095	9.9986135	8.8464968	11.1549267
37	8.8437130	9.9986044	8.8465696	11.1549148
38	8.8437165	9.9985953	8.8466434	11.1549029
39	8.8437200	9.9985862	8.8467182	11.1548910
40	8.8437235	9.9985771	8.8467940	11.1548791
41	8.8437270	9.9985680	8.8468708	11.1548672
42	8.8437305	9.9985589	8.8469486	11.1548553
43	8.8437340	9.9985498	8.8470274	11.1548434
44	8.8437375	9.9985407	8.8471072	11.1548315
45	8.8437410	9.9985316	8.8471880	11.1548196
46	8.8437445	9.9985225	8.8472698	11.1548077
47	8.8437480	9.9985134	8.8473526	11.1547958
48	8.8437515	9.9985043	8.8474364	11.1547839
49	8.8437550	9.9984952	8.8475212	11.1547720
50	8.8437585	9.9984861	8.8476070	11.1547601
51	8.8437620	9.9984770	8.8476938	11.1547482
52	8.8437655	9.9984679	8.8477816	11.1547363
53	8.8437690	9.9984588	8.8478704	11.1547244
54	8.8437725	9.9984497	8.8479602	11.1547125
55	8.8437760	9.9984406	8.8480510	11.1547006
56	8.8437795	9.9984315	8.8481428	11.1546887
57	8.8437830	9.9984224	8.8482356	11.1546768
58	8.8437865	9.9984133	8.8483294	11.1546649
59	8.8437900	9.9984042	8.8484242	11.1546530
60	8.8437935	9.9983951	8.8485200	11.1546411

5 Degrees.				
Min.	Sine	Sine Comp.	Tang.	Tang. Comp.
0	8.9420960	9.9983442	8.9419518	11.0580482
1	8.9421737	9.9983332	8.9434044	11.0585956
2	8.9431743	9.9983220	8.9448523	11.0591477
3	8.9446633	9.9983109	8.9462954	11.0597046
4	8.9460633	9.9982997	8.9477338	11.0602662
5	8.9474561	9.9982885	8.9491766	11.0608324
6	8.9488739	9.9982772	8.9505967	11.0614033
7	8.9502871	9.9982660	8.9520211	11.0619789
8	8.9516957	9.9982546	8.9534410	11.0625592
9	8.9530999	9.9982433	8.9548564	11.0631436
10	8.9544991	9.9982318	8.9562672	11.0637328
11	8.9558940	9.9982204	8.9576735	11.0643265
12	8.9572843	9.9982089	8.9590754	11.0649248
13	8.9586703	9.9981974	8.9604728	11.0655276
14	8.9600521	9.9981859	8.9618659	11.0661341
15	8.9614288	9.9981743	8.9632545	11.0667455
16	8.9628014	9.9981629	8.9646386	11.0673614
17	8.9641697	9.9981510	8.9660188	11.0679818
18	8.9655337	9.9981393	8.9673944	11.0686066
19	8.9668934	9.9981275	8.9687658	11.0692361
20	8.9682487	9.9981158	8.9701330	11.0698707
21	8.9695999	9.9981040	8.9714959	11.0705101
22	8.9709468	9.9980921	8.9728547	11.0711543
23	8.9722885	9.9980802	8.9742092	11.0718038
24	8.9736268	9.9980683	8.9755597	11.0724584
25	8.9749624	9.9980563	8.9769062	11.0731180
26	8.9762926	9.9980443	8.9782483	11.0737827
27	8.9776188	9.9980323	8.9795865	11.0744523
28	8.9789408	9.9980202	8.9809206	11.0751269
29	8.9802589	9.9980081	8.9822507	11.0758063
30	8.9815729	9.9979956	8.9835769	11.0764901
31	8.9828828	9.9979838	8.9848991	11.0771782
32	8.9841889	9.9979716	8.9862173	11.0778708
33	8.9854910	9.9979593	8.9875317	11.0785679
34	8.9867891	9.9979470	8.9888421	11.0792693
35	8.9880834	9.9979347	8.9901487	11.0799751
36	8.9893737	9.9979223	8.9914514	11.0806854
37	8.9906622	9.9979099	8.9927503	11.0813999
38	8.9919420	9.9978975	8.9940454	11.0821187
39	8.9932217	9.9978850	8.9953367	11.0828418
40	8.9944968	9.9978725	8.9966243	11.0835691
41	8.9957681	9.9978599	8.9979081	11.0843006
42	8.9970356	9.9978473	8.9991883	11.0850363
43	8.9982994	9.9978347	9.0004647	11.0857761
44	8.9995595	9.9978220	9.0017375	11.0865200
45	9.0008160	9.9978093	9.0030066	11.0872679
46	9.0020687	9.9977966	9.0042721	11.0880200
47	9.0033179	9.9977838	9.0055340	11.0887761
48	9.0045634	9.9977710	9.0067924	11.0895363
49	9.0058053	9.9977582	9.0080471	11.0903006
50	9.0070436	9.9977453	9.0092984	11.0910691
51	9.0082784	9.9977323	9.0105461	11.0918416
52	9.0095099	9.9977194	9.0117923	11.0926181
53	9.0107374	9.9977064	9.0130310	11.0934006
54	9.0119616	9.9976933	9.0142682	11.0941881
55	9.0131823	9.9976803	9.0155021	11.0949806
56	9.0143996	9.9976672	9.0167325	11.0957781
57	9.0156133	9.9976540	9.0179594	11.0965806
58	9.0168239	9.9976408	9.0191831	11.0973881
59	9.0180309	9.9976276	9.0204033	11.0982006
60	9.0192346	9.9976143	9.0216202	11.0990181

Sine Comp. Sine Tang Comp Tang.

85 Degrees.

Min.

Sine Comp. Sine Tang Comp Tang.

84 Degrees.

Min.

6 Degrees				
Min.	Sine	Sine Com.	Tang.	Tang. Com.
0	9.0192346	9.9976143	9.0216202	10.9783798
1	9.0204348	9.9976011	9.0228338	10.9771662
2	9.0216318	9.9975877	9.0240441	10.9759559
3	9.0228254	9.9975743	9.0252510	10.9747490
4	9.0240157	9.9975609	9.0264548	10.9735452
5	9.0252027	9.9975475	9.0276552	10.9723448
6	9.0263865	9.9975340	9.0288524	10.9711476
7	9.0275669	9.9975205	9.0300463	10.9699536
8	9.0287442	9.9975069	9.0312374	10.9687627
9	9.0299182	9.9974933	9.0324249	10.9675751
10	9.0310890	9.9974797	9.0336095	10.9663907
11	9.0322567	9.9974660	9.0347905	10.9652094
12	9.0334212	9.9974523	9.0359688	10.9640312
13	9.0345825	9.9974386	9.0371430	10.9628561
14	9.0357407	9.9974248	9.0383150	10.9616841
15	9.0368958	9.9974110	9.0394848	10.9605152
16	9.0380477	9.9973971	9.0406506	10.9593494
17	9.0391966	9.9973833	9.0418134	10.9581866
18	9.0403424	9.9973693	9.0429731	10.9570269
19	9.0414852	9.9973554	9.0441290	10.9558701
20	9.0426249	9.9973414	9.0452835	10.9547164
21	9.0437617	9.9973273	9.0464353	10.9535657
22	9.0448954	9.9973132	9.0475821	10.9524179
23	9.0460261	9.9972991	9.0487250	10.9512730
24	9.0471548	9.9972850	9.0498658	10.9501311
25	9.0482806	9.9972708	9.0510045	10.9489922
26	9.0494005	9.9972566	9.0521439	10.9478561
27	9.0505194	9.9972423	9.0532777	10.9467220
28	9.0516344	9.9972280	9.0544077	10.9455916
29	9.0527488	9.9972137	9.0555340	10.9444651
30	9.0538638	9.9971993	9.0566595	10.9433405
31	9.0549661	9.9971849	9.0577832	10.9422187
32	9.0560676	9.9971704	9.0589002	10.9410998
33	9.0571673	9.9971559	9.0600166	10.9399836
34	9.0582651	9.9971414	9.0611297	10.9388703
35	9.0593611	9.9971268	9.0622405	10.9377597
36	9.0604560	9.9971122	9.0633482	10.9366518
37	9.0615509	9.9970976	9.0644533	10.9355467
38	9.0626386	9.9970829	9.0655556	10.9344444
39	9.0637233	9.9970682	9.0666555	10.9333447
40	9.0648057	9.9970535	9.0677522	10.9322478
41	9.0658852	9.9970387	9.0688465	10.9311535
42	9.0669619	9.9970239	9.0699381	10.9300610
43	9.0680360	9.9970090	9.0710270	10.9289730
44	9.0691074	9.9969941	9.0721133	10.9278867
45	9.0701761	9.9969792	9.0731960	10.9268021
46	9.0712421	9.9969642	9.0742757	10.9257221
47	9.0723055	9.9969492	9.0753563	10.9246437
48	9.0733663	9.9969342	9.0764321	10.9235679
49	9.0744244	9.9969191	9.0775055	10.9224947
50	9.0754799	9.9969040	9.0785760	10.9214240
51	9.0765320	9.9968888	9.0796441	10.9203559
52	9.0775812	9.9968736	9.0807096	10.9192904
53	9.0786280	9.9968584	9.0817726	10.9182274
54	9.0796762	9.9968431	9.0828331	10.9171660
55	9.0807189	9.9968278	9.0838911	10.9161080
56	9.0817590	9.9968125	9.0849466	10.9150534
57	9.0827966	9.9967971	9.0859996	10.9140004
58	9.0838317	9.9967817	9.0870501	10.9129499
59	9.0848643	9.9967662	9.0880981	10.9119010
60	9.0858945	9.9967507	9.0891438	10.9108562
Sine Comp.	Sine	Tang. Com.	Tang.	Min.

83 Degrees

7 Degrees				
Min.	Sine	Sine Com.	Tang.	Tang. Com.
0	9.0858945	9.9967357	9.0891438	10.9108562
1	9.0869621	9.9967352	9.0901869	10.9098131
2	9.0879743	9.9967350	9.0912277	10.9087723
3	9.0889307	9.9967349	9.0922660	10.9077340
4	9.0899302	9.9967348	9.0933020	10.9066980
5	9.0909108	9.9967347	9.0943355	10.9056645
6	9.0918727	9.9967346	9.0953667	10.9046333
7	9.0928237	9.9967345	9.0963955	10.9036045
8	9.0937637	9.9967344	9.0974227	10.9025781
9	9.0946925	9.9967343	9.0984468	10.9015540
10	9.0956101	9.9967342	9.0994670	10.9005322
11	9.0965165	9.9967341	9.1004872	10.8995128
12	9.0974118	9.9967340	9.1015044	10.8984956
13	9.0982960	9.9967339	9.1025192	10.8974808
14	9.0991691	9.9967338	9.1035317	10.8964683
15	9.1000311	9.9967337	9.1045410	10.8954580
16	9.1008821	9.9967336	9.1055550	10.8944500
17	9.1017221	9.9967335	9.1065557	10.8934443
18	9.1025511	9.9967334	9.1075591	10.8924409
19	9.1033691	9.9967333	9.1085564	10.8914366
20	9.1041761	9.9967332	9.1095504	10.8904340
21	9.1049721	9.9967331	9.1105562	10.8894338
22	9.1057571	9.9967330	9.1115508	10.8884359
23	9.1065311	9.9967329	9.1125431	10.8874397
24	9.1072951	9.9967328	9.1135333	10.8864467
25	9.1080491	9.9967327	9.1145213	10.8854577
26	9.1087931	9.9967326	9.1155072	10.8844628
27	9.1095271	9.9967325	9.1164909	10.8834733
28	9.1102511	9.9967324	9.1174724	10.8824876
29	9.1109651	9.9967323	9.1184518	10.8815058
30	9.1116691	9.9967322	9.1194291	10.8805293
31	9.1123631	9.9967321	9.1204043	10.8795579
32	9.1130471	9.9967320	9.1213773	10.8785922
33	9.1137211	9.9967319	9.1223482	10.8776327
34	9.1143851	9.9967318	9.1233171	10.8766789
35	9.1150391	9.9967317	9.1242839	10.8757315
36	9.1156831	9.9967316	9.1252486	10.8747914
37	9.1163171	9.9967315	9.1262112	10.8738588
38	9.1169411	9.9967314	9.1271718	10.8729322
39	9.1175551	9.9967313	9.1281303	10.8719927
40	9.1181591	9.9967312	9.1290868	10.8710599
41	9.1187531	9.9967311	9.1300413	10.8696587
42	9.1193371	9.9967310	9.1309937	10.8686003
43	9.1199111	9.9967309	9.1319442	10.8680558
44	9.1204751	9.9967308	9.1328926	10.8675174
45	9.1210291	9.9967307	9.1338391	10.8669859
46	9.1215731	9.9967306	9.1347835	10.8664583
47	9.1221071	9.9967305	9.1357260	10.8659369
48	9.1226311	9.9967304	9.1366665	10.8654214
49	9.1231451	9.9967303	9.1376051	10.8649135
50	9.1236491	9.9967302	9.1385417	10.8644130
51	9.1241431	9.9967301	9.1394764	10.8639236
52	9.1246271	9.9967300	9.1404090	10.8634468
53	9.1251011	9.9967299	9.1413400	10.8629800
54	9.1255651	9.9967298	9.1422689	10.8625231
55	9.1260191	9.9967297	9.1431959	10.8620764
56	9.1264631	9.9967296	9.1441210	10.8616400
57	9.1268971	9.9967295	9.1450450	10.8612136
58	9.1273211	9.9967294	9.1459695	10.8607972
59	9.1277351	9.9967293	9.1468830	10.8603908
60	9.1281391	9.9967292	9.1477965	10.8599944
Sine Com.	Sine	Tang. Com.	Tang.	Min.

85 Degrees

Min.	8 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.1435553	9.9957528	9.1478025	10.8521975	60
1	9.1444532	9.9957350	9.1487182	10.8512818	59
2	9.1453493	9.9957172	9.1496321	10.8503679	58
3	9.1462433	9.9956993	9.1505441	10.8494539	57
4	9.1471358	9.9956815	9.1514543	10.8485457	56
5	9.1480262	9.9956635	9.1523627	10.8476378	55
6	9.1489148	9.9956456	9.1532692	10.8467308	54
7	9.1498015	9.9956276	9.1541739	10.8458261	53
8	9.1506864	9.9956095	9.1550769	10.8449231	52
9	9.1515694	9.9955915	9.1559780	10.8440220	51
10	9.1524507	9.9955734	9.1568773	10.8431227	50
11	9.1533301	9.9955552	9.1577748	10.8422252	49
12	9.1542076	9.9955370	9.1586706	10.8413294	48
13	9.1550834	9.9955188	9.1595646	10.8404354	47
14	9.1559574	9.9955005	9.1604569	10.8395431	46
15	9.1568296	9.9954822	9.1613473	10.8386527	45
16	9.1577000	9.9954639	9.1622361	10.8377639	44
17	9.1585686	9.9954455	9.1631231	10.8368769	43
18	9.1594354	9.9954271	9.1640083	10.8359917	42
19	9.1603005	9.9954087	9.1648910	10.8351081	41
20	9.1611639	9.9953902	9.1657737	10.8342263	40
21	9.1620254	9.9953717	9.1666538	10.8333462	39
22	9.1628853	9.9953531	9.1675322	10.8324678	38
23	9.1637434	9.9953345	9.1684089	10.8315911	37
24	9.1645995	9.9953159	9.1692839	10.8307161	36
25	9.1654544	9.9952972	9.1701572	10.8298428	35
26	9.1663074	9.9952785	9.1710289	10.8289711	34
27	9.1671586	9.9952597	9.1718989	10.8281001	33
28	9.1680081	9.9952409	9.1727672	10.8272328	32
29	9.1688559	9.9952221	9.1736339	10.8263686	31
30	9.1697021	9.9952033	9.1744988	10.8255073	30
31	9.1705465	9.9951844	9.1753622	10.8246438	29
32	9.1713893	9.9951654	9.1762239	10.8237761	28
33	9.1722305	9.9951464	9.1770840	10.8229062	27
34	9.1730699	9.9951274	9.1779425	10.8220345	26
35	9.1739077	9.9951084	9.1787993	10.8211607	25
36	9.1747439	9.9950893	9.1796546	10.8202844	24
37	9.1755784	9.9950702	9.1805082	10.8194091	23
38	9.1764112	9.9950510	9.1813602	10.8185358	22
39	9.1772425	9.9950318	9.1822106	10.8176644	21
40	9.1780721	9.9950126	9.1830595	10.8167945	20
41	9.1789001	9.9949933	9.1839068	10.8159263	19
42	9.1797266	9.9949740	9.1847525	10.8150598	18
43	9.1805512	9.9949546	9.1855966	10.8141943	17
44	9.1813744	9.9949352	9.1864392	10.8133308	16
45	9.1821966	9.9949158	9.1872802	10.8124693	15
46	9.1830169	9.9948964	9.1881196	10.8116094	14
47	9.1838344	9.9948769	9.1889575	10.8107513	13
48	9.1846499	9.9948573	9.1897939	10.8098949	12
49	9.1854665	9.9948377	9.1906287	10.8090392	11
50	9.1862822	9.9948181	9.1914621	10.8081839	10
51	9.1870923	9.9947985	9.1922939	10.8073291	9
52	9.1879029	9.9947788	9.1931241	10.8064750	8
53	9.1887120	9.9947591	9.1939529	10.8056217	7
54	9.1895195	9.9947393	9.1947802	10.8047690	6
55	9.1903254	9.9947195	9.1956059	10.8039169	5
56	9.1911299	9.9946997	9.1964302	10.8030658	4
57	9.1919328	9.9946798	9.1972530	10.8022150	3
58	9.1927342	9.9946599	9.1980743	10.8013647	2
59	9.1935341	9.9946399	9.1988941	10.8005149	1
60	9.1943324	9.9946199	9.1997125	10.8000655	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	

81 Degrees

Min.	9 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.1943324	9.9946199	9.1997125	10.8000655	60
1	9.1951293	9.9945999	9.2005249	10.7994706	59
2	9.1959247	9.9945798	9.2013354	10.7988751	58
3	9.1967186	9.9945597	9.2021438	10.7982802	57
4	9.1975110	9.9945396	9.2029514	10.7976856	56
5	9.1983019	9.9945194	9.2037582	10.7970911	55
6	9.1990913	9.9944992	9.2045622	10.7964968	54
7	9.1998793	9.9944789	9.2053644	10.7959026	53
8	9.2006658	9.9944587	9.2061657	10.7953085	52
9	9.2014509	9.9944383	9.2069662	10.7947145	51
10	9.2022345	9.9944180	9.2077658	10.7941205	50
11	9.2030167	9.9943975	9.2085646	10.7935265	49
12	9.2037977	9.9943771	9.2093625	10.7929325	48
13	9.2045766	9.9943566	9.2101594	10.7923385	47
14	9.2053545	9.9943361	9.2109554	10.7917445	46
15	9.2061313	9.9943156	9.2117504	10.7911505	45
16	9.2069069	9.9942950	9.2125444	10.7905565	44
17	9.2076793	9.9942743	9.2133374	10.7899625	43
18	9.2084495	9.9942537	9.2141294	10.7893685	42
19	9.2092184	9.9942330	9.2149204	10.7887745	41
20	9.2099857	9.9942122	9.2157104	10.7881805	40
21	9.2107517	9.9941914	9.2164994	10.7875865	39
22	9.2115163	9.9941706	9.2172874	10.7869925	38
23	9.2122794	9.9941498	9.2180744	10.7863985	37
24	9.2130412	9.9941289	9.2188604	10.7858045	36
25	9.2138017	9.9941079	9.2196464	10.7852105	35
26	9.2145608	9.9940870	9.2204314	10.7846165	34
27	9.2153184	9.9940659	9.2212154	10.7840225	33
28	9.2160745	9.9940449	9.2220004	10.7834285	32
29	9.2168291	9.9940238	9.2227844	10.7828345	31
30	9.2175822	9.9940027	9.2235684	10.7822405	30
31	9.2183338	9.9939815	9.2243514	10.7816465	29
32	9.2190839	9.9939603	9.2251344	10.7810525	28
33	9.2198325	9.9939391	9.2259164	10.7804585	27
34	9.2205796	9.9939178	9.2266984	10.7798645	26
35	9.2213251	9.9938965	9.2274804	10.7792705	25
36	9.2220691	9.9938752	9.2282614	10.7786765	24
37	9.2228116	9.9938538	9.2290424	10.7780825	23
38	9.2235526	9.9938324	9.2298224	10.7774885	22
39	9.2242921	9.9938109	9.2306024	10.7768945	21
40	9.2250301	9.9937894	9.2313814	10.7763005	20
41	9.2257665	9.9937679	9.2321604	10.7757065	19
42	9.2265015	9.9937463	9.2329384	10.7751125	18
43	9.2272351	9.9937247	9.2337164	10.7745185	17
44	9.2279671	9.9937030	9.2344934	10.7739245	16
45	9.2286976	9.9936813	9.2352704	10.7733305	15
46	9.2294265	9.9936596	9.2360464	10.7727365	14
47	9.2301539	9.9936378	9.2368224	10.7721425	13
48	9.2308798	9.9936160	9.2375984	10.7715485	12
49	9.2316043	9.9935942	9.2383734	10.7709545	11
50	9.2323274	9.9935723	9.2391484	10.7703605	10
51	9.2330491	9.9935504	9.2399224	10.7697665	9
52	9.2337695	9.9935285	9.2406964	10.7691725	8
53	9.2344886	9.9935065	9.2414704	10.7685785	7
54	9.2352064	9.9934844	9.2422434	10.7679845	6
55	9.2359229	9.9934624	9.2430164	10.7673905	5
56	9.2366381	9.9934403	9.2437884	10.7667965	4
57	9.2373521	9.9934181	9.2445604	10.7662025	3
58	9.2380649	9.9933959	9.2453324	10.7656085	2
59	9.2387765	9.9933737	9.2461044	10.7650145	1
60	9.2394869	9.9933515	9.2468764	10.7644205	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	

80 Degrees

Min.	10 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Com.	
0	9.2306702	9.9933515	9.2463188	10.7536812	60
1	9.2403861	9.9933208	9.2470599	10.7539431	59
2	9.2411007	9.9933068	9.2477539	10.7542061	58
3	9.2418141	9.9932881	9.2484529	10.7544703	57
4	9.2425264	9.9932621	9.2491643	10.7547357	56
5	9.2432374	9.9932396	9.2498978	10.7550022	55
6	9.2439472	9.9932191	9.2505301	10.7492699	54
7	9.2446558	9.9931947	9.2511612	10.7485388	53
8	9.2453632	9.9931720	9.2517912	10.7478088	52
9	9.2460695	9.9931404	9.2524200	10.7470800	51
10	9.2467746	9.9931268	9.2530477	10.7463523	50
11	9.2474784	9.9931041	9.2536743	10.7456257	49
12	9.2481811	9.9930814	9.2543099	10.7449003	48
13	9.2488827	9.9930587	9.2549445	10.7441760	47
14	9.2495830	9.9930359	9.2555782	10.7434528	46
15	9.2502822	9.9930131	9.2562109	10.7427308	45
16	9.2509803	9.9929902	9.2568425	10.7420099	44
17	9.2516772	9.9929673	9.2574739	10.7412901	43
18	9.2523729	9.9929444	9.2581042	10.7405715	42
19	9.2530675	9.9929214	9.2587334	10.7398539	41
20	9.2537609	9.9928984	9.2593615	10.7391375	40
21	9.2544532	9.9928753	9.2600000	10.7384221	39
22	9.2551444	9.9928522	9.2606379	10.7377079	38
23	9.2558344	9.9928291	9.2612751	10.7369947	37
24	9.2565232	9.9928059	9.2619115	10.7362827	36
25	9.2572110	9.9927827	9.2625472	10.7355713	35
26	9.2578977	9.9927595	9.2631821	10.7348613	34
27	9.2585832	9.9927362	9.2638162	10.7341530	33
28	9.2592676	9.9927129	9.2644495	10.7334453	32
29	9.2599509	9.9926895	9.2650820	10.7327387	31
30	9.2606332	9.9926661	9.2657136	10.7320331	30
31	9.2613141	9.9926427	9.2663443	10.7313280	29
32	9.2619941	9.9926192	9.2669741	10.7306251	28
33	9.2626729	9.9925957	9.2676030	10.7299248	27
34	9.2633507	9.9925722	9.2682311	10.7292244	26
35	9.2640274	9.9925486	9.2688583	10.7285242	25
36	9.2647030	9.9925250	9.2694846	10.7278240	24
37	9.2653775	9.9925013	9.2701100	10.7271238	23
38	9.2660509	9.9924776	9.2707345	10.7264237	22
39	9.2667232	9.9924539	9.2713581	10.7257236	21
40	9.2673945	9.9924301	9.2719816	10.7250235	20
41	9.2680647	9.9924063	9.2726051	10.7243234	19
42	9.2687338	9.9923824	9.2732286	10.7236233	18
43	9.2694019	9.9923585	9.2738521	10.7229232	17
44	9.2700689	9.9923346	9.2744756	10.7222231	16
45	9.2707348	9.9923106	9.2750991	10.7215230	15
46	9.2713997	9.9922866	9.2757226	10.7208229	14
47	9.2720635	9.9922626	9.2763461	10.7201228	13
48	9.2727263	9.9922385	9.2769696	10.7194227	12
49	9.2733880	9.9922144	9.2775931	10.7187226	11
50	9.2740487	9.9921902	9.2782166	10.7180225	10
51	9.2747083	9.9921660	9.2788401	10.7173224	9
52	9.2753669	9.9921418	9.2794636	10.7166223	8
53	9.2760245	9.9921175	9.2800871	10.7159222	7
54	9.2766811	9.9920932	9.2807106	10.7152221	6
55	9.2773366	9.9920689	9.2813341	10.7145220	5
56	9.2779911	9.9920445	9.2819576	10.7138219	4
57	9.2786445	9.9920201	9.2825811	10.7131218	3
58	9.2792979	9.9919956	9.2832046	10.7124217	2
59	9.2799484	9.9919711	9.2838281	10.7117216	1
60	9.2805988	9.9919466	9.2844516	10.7110215	0
Sine Comp.	Sine	Tang. Com.	Tang.	Min.	

79 Degrees

Min.	11 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Com.	
0	9.2805988	9.9919466	9.2844516	10.7110215	60
1	9.2812483	9.9919220	9.2850751	10.7103214	59
2	9.2818967	9.9918974	9.2856986	10.7096213	58
3	9.2825441	9.9918727	9.2863221	10.7089212	57
4	9.2831905	9.9918480	9.2869456	10.7082211	56
5	9.2838359	9.9918233	9.2875691	10.7075210	55
6	9.2844803	9.9917986	9.2881926	10.7068209	54
7	9.2851237	9.9917739	9.2888161	10.7061208	53
8	9.2857661	9.9917492	9.2894396	10.7054207	52
9	9.2864085	9.9917245	9.2900631	10.7047206	51
10	9.2870488	9.9916991	9.2906866	10.7040205	50
11	9.2876873	9.9916741	9.2913101	10.7033204	49
12	9.2883246	9.9916492	9.2919336	10.7026203	48
13	9.2889606	9.9916241	9.2925571	10.7019202	47
14	9.2895960	9.9915990	9.2931806	10.7012201	46
15	9.2902357	9.9915739	9.2938041	10.7005200	45
16	9.2908704	9.9915488	9.2944276	10.6998199	44
17	9.2915040	9.9915236	9.2950511	10.6991198	43
18	9.2921367	9.9914984	9.2956746	10.6984197	42
19	9.2927685	9.9914731	9.2962981	10.6977196	41
20	9.2933993	9.9914478	9.2969216	10.6970195	40
21	9.2940291	9.9914225	9.2975451	10.6963194	39
22	9.2946580	9.9913971	9.2981686	10.6956193	38
23	9.2952859	9.9913717	9.2987921	10.6949192	37
24	9.2959137	9.9913462	9.2994156	10.6942191	36
25	9.2965409	9.9913207	9.2999391	10.6935190	35
26	9.2971671	9.9912952	9.3005626	10.6928189	34
27	9.2977883	9.9912696	9.3011861	10.6921188	33
28	9.2984116	9.9912440	9.3018096	10.6914187	32
29	9.2990339	9.9912184	9.3024331	10.6907186	31
30	9.2996553	9.9911927	9.3030566	10.6900185	30
31	9.3002758	9.9911670	9.3036801	10.6893184	29
32	9.3008953	9.9911412	9.3043036	10.6886183	28
33	9.3015147	9.9911154	9.3049271	10.6879182	27
34	9.3021341	9.9910896	9.3055506	10.6872181	26
35	9.3027535	9.9910637	9.3061741	10.6865180	25
36	9.3033729	9.9910378	9.3067976	10.6858179	24
37	9.3039924	9.9910119	9.3074211	10.6851178	23
38	9.3046118	9.9909859	9.3080446	10.6844177	22
39	9.3052312	9.9909598	9.3086681	10.6837176	21
40	9.3058506	9.9909338	9.3092916	10.6830175	20
41	9.3064699	9.9909077	9.3099151	10.6823174	19
42	9.3070893	9.9908815	9.3105386	10.6816173	18
43	9.3077087	9.9908553	9.3111621	10.6809172	17
44	9.3083280	9.9908291	9.3117856	10.6802171	16
45	9.3089474	9.9908029	9.3124091	10.6795170	15
46	9.3095668	9.9907766	9.3130326	10.6788169	14
47	9.3101861	9.9907502	9.3136561	10.6781168	13
48	9.3108055	9.9907239	9.3142796	10.6774167	12
49	9.3114249	9.9906974	9.3149031	10.6767166	11
50	9.3120443	9.9906710	9.3155266	10.6760165	10
51	9.3126637	9.9906445	9.3161501	10.6753164	9
52	9.3132831	9.9906180	9.3167736	10.6746163	8
53	9.3139025	9.9905914	9.3173971	10.6739162	7
54	9.3145219	9.9905648	9.3180206	10.6732161	6
55	9.3151413	9.9905382	9.3186441	10.6725160	5
56	9.3157607	9.9905115	9.3192676	10.6718159	4
57	9.3163801	9.9904848	9.3198911	10.6711158	3
58	9.3169995	9.9904580	9.3205146	10.6704157	2
59	9.3176189	9.9904312	9.3211381	10.6697156	1
60	9.3182383	9.9904044	9.3217616	10.6690155	0
Sine Comp.	Sine	Tang. Com.	Tang.	Min.	

78 Degrees

SINES AND TANGENTS.

171

Min.	12 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.3178789	9.9902404	9.3274745	10.6725255	60
1	9.3184728	9.9903775	9.3282953	10.6719047	59
2	9.3190659	9.9905150	9.3287153	10.6712847	58
3	9.3196581	9.9906527	9.3293334	10.6706655	57
4	9.3202495	9.9907902	9.3299528	10.6700472	56
5	9.3208400	9.9909269	9.3305724	10.6694290	55
6	9.3214297	9.9910625	9.3311872	10.6688128	54
7	9.3220185	9.9911979	9.3318031	10.6681969	53
8	9.3226066	9.9913333	9.3324183	10.6675815	52
9	9.3231938	9.9914685	9.3330333	10.6669667	51
10	9.3237802	9.9916033	9.3336483	10.6663537	50
11	9.3243657	9.9917376	9.3342631	10.6657409	49
12	9.3249505	9.9918715	9.3348771	10.6651280	48
13	9.3255344	9.9920051	9.3354923	10.6645157	47
14	9.3261174	9.9921384	9.3361072	10.6639037	46
15	9.3266997	9.9922715	9.3367224	10.6632916	45
16	9.3272811	9.9924043	9.3373371	10.6626857	44
17	9.3278617	9.9925369	9.3379514	10.6620806	43
18	9.3284416	9.9926691	9.3385657	10.6614733	42
19	9.3290206	9.9928011	9.3391803	10.6608667	41
20	9.3295988	9.9929328	9.3397941	10.6602609	40
21	9.3301761	9.9930643	9.3404081	10.6596559	39
22	9.3307527	9.9931955	9.3409484	10.6590516	38
23	9.3313285	9.9933264	9.3415519	10.6584481	37
24	9.3319035	9.9934570	9.3421556	10.6578454	36
25	9.3324777	9.9935871	9.3427596	10.6572434	35
26	9.3330511	9.9937169	9.3433638	10.6566422	34
27	9.3336237	9.9938464	9.3439683	10.6560417	33
28	9.3341955	9.9939757	9.3445730	10.6554420	32
29	9.3347665	9.9941047	9.3451770	10.6548430	31
30	9.3353368	9.9942335	9.3457812	10.6542448	30
31	9.3359062	9.9943620	9.3463857	10.6536473	29
32	9.3364749	9.9944902	9.3469904	10.6530506	28
33	9.3370428	9.9946181	9.3475954	10.6524546	27
34	9.3376099	9.9947459	9.3481407	10.6518593	26
35	9.3381762	9.9948734	9.3487352	10.6512648	25
36	9.3387418	9.9950007	9.3493299	10.6506710	24
37	9.3393065	9.9951278	9.3499249	10.6500780	23
38	9.3398706	9.9952547	9.3505194	10.6494857	22
39	9.3404338	9.9953814	9.3511140	10.6488941	21
40	9.3409963	9.9955080	9.3517088	10.6483032	20
41	9.3415581	9.9956343	9.3523037	10.6477131	19
42	9.3421190	9.9957604	9.3528986	10.6471237	18
43	9.3426792	9.9958863	9.3534936	10.6465350	17
44	9.3432386	9.9960120	9.3540886	10.6459470	16
45	9.3437973	9.9961375	9.3546837	10.6453598	15
46	9.3443552	9.9962628	9.3552787	10.6447733	14
47	9.3449124	9.9963879	9.3558736	10.6441874	13
48	9.3454688	9.9965128	9.3564687	10.6436023	12
49	9.3460245	9.9966375	9.3570638	10.6430179	11
50	9.3465794	9.9967620	9.3576589	10.6424342	10
51	9.3471336	9.9968864	9.3582538	10.6418513	9
52	9.3476870	9.9970106	9.3588487	10.6412690	8
53	9.3482397	9.9971347	9.3594436	10.6406874	7
54	9.3487917	9.9972586	9.3600385	10.6401065	6
55	9.3493420	9.9973823	9.3606335	10.6395264	5
56	9.3498934	9.9975059	9.3612284	10.6389469	4
57	9.3504432	9.9976293	9.3618233	10.6383681	3
58	9.3509922	9.9977525	9.3624182	10.6377900	2
59	9.3515405	9.9978756	9.3630131	10.6372126	1
60	9.3520880	9.9979985	9.3636080	10.6366359	0
Sine Comp.				Sine	
				Tang. Comp.	Tang.

77 Degrees

Min.	13 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.3520880	9.9987239	9.3636034	10.6360639	60
1	9.3526349	9.9988497	9.3642081	10.6354859	59
2	9.3531810	9.9989755	9.3648128	10.6349079	58
3	9.3537264	9.9991013	9.3654175	10.6343299	57
4	9.3542710	9.9992270	9.3660222	10.6337519	56
5	9.3548150	9.9993527	9.3666269	10.6331739	55
6	9.3553582	9.9994784	9.3672316	10.6325959	54
7	9.3559013	9.9996041	9.3678363	10.6320179	53
8	9.3564446	9.9997298	9.3684410	10.6314399	52
9	9.3569878	9.9998555	9.3690457	10.6308619	51
10	9.3575310	9.9999812	9.3696504	10.6302839	50
11	9.3580743	9.9991069	9.3702551	10.6297059	49
12	9.3586175	9.9992326	9.3708598	10.6291279	48
13	9.3591608	9.9993583	9.3714645	10.6285499	47
14	9.3597040	9.9994840	9.3720692	10.6279719	46
15	9.3602473	9.9996097	9.3726739	10.6273939	45
16	9.3607905	9.9997354	9.3732786	10.6268159	44
17	9.3613338	9.9998611	9.3738833	10.6262379	43
18	9.3618771	9.9999868	9.3744880	10.6256599	42
19	9.3624204	9.9991125	9.3750927	10.6250819	41
20	9.3629637	9.9992382	9.3756974	10.6245039	40
21	9.3635070	9.9993639	9.3763021	10.6239259	39
22	9.3640503	9.9994896	9.3769068	10.6233479	38
23	9.3645936	9.9996153	9.3775115	10.6227699	37
24	9.3651369	9.9997410	9.3781162	10.6221919	36
25	9.3656802	9.9998667	9.3787209	10.6216139	35
26	9.3662235	9.9999924	9.3793256	10.6210359	34
27	9.3667668	9.9991181	9.3799303	10.6204579	33
28	9.3673101	9.9992438	9.3805350	10.6198799	32
29	9.3678534	9.9993695	9.3811397	10.6193019	31
30	9.3683967	9.9994952	9.3817444	10.6187239	30
31	9.3689400	9.9996209	9.3823491	10.6181459	29
32	9.3694833	9.9997466	9.3829538	10.6175679	28
33	9.3700266	9.9998723	9.3835585	10.6169899	27
34	9.3705699	9.9999980	9.3841632	10.6164119	26
35	9.3711132	9.9991237	9.3847679	10.6158339	25
36	9.3716565	9.9992494	9.3853726	10.6152559	24
37	9.3722000	9.9993751	9.3859773	10.6146779	23
38	9.3727433	9.9995008	9.3865820	10.6140999	22
39	9.3732866	9.9996265	9.3871867	10.6135219	21
40	9.3738299	9.9997522	9.3877914	10.6129439	20
41	9.3743732	9.9998779	9.3883961	10.6123659	19
42	9.3749165	9.9991036	9.3890008	10.6117879	18
43	9.3754598	9.9992293	9.3896055	10.6112099	17
44	9.3760031	9.9993550	9.3902102	10.6106319	16
45	9.3765464	9.9994807	9.3908149	10.6100539	15
46	9.3770897	9.9996064	9.3914196	10.6094759	14
47	9.3776330	9.9997321	9.3920243	10.6088979	13
48	9.3781763	9.9998578	9.3926290	10.6083199	12
49	9.3787196	9.9999835	9.3932337	10.6077419	11
50	9.3792629	9.9991092	9.3938384	10.6071639	10
51	9.3798062	9.9992349	9.3944431	10.6065859	9
52	9.3803495	9.9993606	9.3950478	10.6060079	8
53	9.3808928	9.9994863	9.3956525	10.6054299	7
54	9.3814361	9.9996120	9.3962572	10.6048519	6
55	9.3819794	9.9997377	9.3968619	10.6042739	5
56	9.3825227	9.9998634	9.3974666	10.6036959	4
57	9.3830660	9.9999891	9.3980713	10.6031179	3
58	9.3836093	9.9991148	9.3986760	10.6025399	2
59	9.3841526	9.9992405	9.3992807	10.6019619	1
60	9.3846959	9.9993662	9.3998854	10.6013839	0
Sine Comp.				Sine	
				Tang. Comp.	Tang.

76 Degrees

LOGARITHMIC TABLE OF

Min.	14 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.836752	0.9869041	9.3967711	10.6032289	60
1	9.8368181	0.9868726	9.3973089	10.6026911	59
2	9.8368873	0.9868410	9.3978463	10.6021537	58
3	9.8369524	0.9868094	9.3983830	10.6016170	57
4	9.8369696	0.9867778	9.3989191	10.6010809	56
5	9.8369200	0.9867461	9.3994547	10.6005453	55
6	9.8369040	0.9867144	9.3999896	10.6000104	54
7	9.8368706	0.9866827	9.4005240	10.5994760	53
8	9.8368377	0.9866509	9.4010578	10.5989422	52
9	9.8368210	0.9866191	9.4015910	10.5984090	51
10	9.8367709	0.9865872	9.4021237	10.5978763	50
11	9.8367211	0.9865553	9.4026558	10.5973442	49
12	9.8367106	0.9865233	9.4031873	10.5968127	48
13	9.8366296	0.9864913	9.4037182	10.5962818	47
14	9.8369707	0.9864593	9.4042486	10.5957514	46
15	9.8312057	0.9864273	9.4047784	10.5952210	45
16	9.8312111	0.9863952	9.4053076	10.5946924	44
17	9.8321993	0.9863630	9.4058363	10.5941637	43
18	9.8329225	0.9863308	9.4063644	10.5936350	42
19	9.8331005	0.9862986	9.4068919	10.5931061	41
20	9.8336852	0.9862663	9.4074189	10.5925781	40
21	9.8341794	0.9862340	9.4079453	10.5920507	39
22	9.8346729	0.9862017	9.4084712	10.5915288	38
23	9.8351658	0.9861693	9.4089965	10.5910035	37
24	9.8356581	0.9861369	9.4095212	10.5904783	36
25	9.8361499	0.9861045	9.4100454	10.5899540	35
26	9.8366410	0.9860720	9.4105690	10.5894304	34
27	9.8371315	0.9860394	9.4110921	10.5889073	33
28	9.8376215	0.9860069	9.4116146	10.5883854	32
29	9.8381109	0.9859742	9.4121366	10.5878634	31
30	9.8385996	0.9859416	9.4126581	10.5873419	30
31	9.8390878	0.9859089	9.4131789	10.5868211	29
32	9.8395754	0.9858762	9.4136993	10.5863007	28
33	9.8400625	0.9858434	9.4142191	10.5857809	27
34	9.8405489	0.9858106	9.4147383	10.5852617	26
35	9.8410348	0.9857777	9.4152570	10.5847430	25
36	9.8415201	0.9857449	9.4157752	10.5842248	24
37	9.8420048	0.9857119	9.4162928	10.5837072	23
38	9.8424889	0.9856790	9.4168099	10.5831901	22
39	9.8429734	0.9856460	9.4173265	10.5826735	21
40	9.8434554	0.9856129	9.4178425	10.5821570	20
41	9.8439378	0.9855798	9.4183580	10.5816420	19
42	9.8444196	0.9855467	9.4188729	10.5811271	18
43	9.8449009	0.9855135	9.4193874	10.5806125	17
44	9.8453816	0.9854803	9.4199013	10.5800987	16
45	9.8458617	0.9854471	9.4204146	10.5795854	15
46	9.8463413	0.9854138	9.4209275	10.5790725	14
47	9.8468203	0.9853805	9.4214398	10.5785602	13
48	9.8472987	0.9853471	9.4219515	10.5780484	12
49	9.8477766	0.9853138	9.4224628	10.5775371	11
50	9.8482539	0.9852803	9.4229735	10.5770261	10
51	9.8487306	0.9852468	9.4234838	10.5765162	9
52	9.8492068	0.9852133	9.4239935	10.5760065	8
53	9.8496829	0.9851798	9.4245026	10.5754974	7
54	9.8501575	0.9851462	9.4250113	10.5749887	6
55	9.8506320	0.9851125	9.4255194	10.5744806	5
56	9.8511059	0.9850789	9.4260271	10.5739720	4
57	9.8515793	0.9850452	9.4265342	10.5734638	3
58	9.8520522	0.9850114	9.4270408	10.5729552	2
59	9.8525254	0.9849776	9.4275469	10.5724461	1
60	9.8529986	0.9849438	9.4280525	10.5719375	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

75 Degrees

Min.	15 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4129962	0.9849438	9.4280525	10.5719375	60
1	9.4134674	0.9849099	9.4285575	10.5714425	59
2	9.4139381	0.9848760	9.4290621	10.5709379	58
3	9.4144082	0.9848420	9.4295661	10.5704339	57
4	9.4148778	0.9848081	9.4300697	10.5699303	56
5	9.4153468	0.9847740	9.4305727	10.5694274	55
6	9.4158152	0.9847400	9.4310753	10.5689247	54
7	9.4162832	0.9847059	9.4315773	10.5684227	53
8	9.4167506	0.9846717	9.4320799	10.5679211	52
9	9.4172174	0.9846375	9.4325799	10.5674201	51
10	9.4176837	0.9846033	9.4330788	10.5669196	50
11	9.4181495	0.9845690	9.4335785	10.5664195	49
12	9.4186148	0.9845347	9.4340780	10.5659200	48
13	9.4190795	0.9845004	9.4345773	10.5654209	47
14	9.4195436	0.9844660	9.4350776	10.5649224	46
15	9.4200073	0.9844316	9.4355757	10.5644243	45
16	9.4204704	0.9843971	9.4360733	10.5639267	44
17	9.4209330	0.9843626	9.4365704	10.5634294	43
18	9.4213959	0.9843281	9.4370670	10.5629320	42
19	9.4218586	0.9842935	9.4375631	10.5624369	41
20	9.4223216	0.9842589	9.4380587	10.5619413	40
21	9.4227840	0.9842242	9.4385538	10.5614460	39
22	9.4232458	0.9841895	9.4390485	10.5609515	38
23	9.4237074	0.9841548	9.4395426	10.5604574	37
24	9.4241683	0.9841200	9.4400363	10.5599637	36
25	9.4246284	0.9840852	9.4405295	10.5594705	35
26	9.4250876	0.9840503	9.4410222	10.5589778	34
27	9.4255469	0.9840154	9.4415145	10.5584853	33
28	9.4259967	0.9839805	9.4420066	10.5579933	32
29	9.4264430	0.9839455	9.4424975	10.5575021	31
30	9.4268988	0.9839105	9.4429883	10.5570119	30
31	9.4273541	0.9838755	9.4434786	10.5565214	29
32	9.4278089	0.9838404	9.4439685	10.5560315	28
33	9.4282631	0.9838052	9.4444579	10.5555421	27
34	9.4287169	0.9837701	9.4449468	10.5550532	26
35	9.4291701	0.9837348	9.4454352	10.5545648	25
36	9.4296228	0.9836996	9.4459232	10.5540768	24
37	9.4300750	0.9836643	9.4464107	10.5535893	23
38	9.4305267	0.9836290	9.4468978	10.5531022	22
39	9.4309779	0.9835936	9.4473843	10.5526155	21
40	9.4314286	0.9835582	9.4478704	10.5521290	20
41	9.4318788	0.9835227	9.4483561	10.5516439	19
42	9.4323283	0.9834872	9.4488413	10.5511589	18
43	9.4327777	0.9834517	9.4493260	10.5506747	17
44	9.4332264	0.9834161	9.4498102	10.5501908	16
45	9.4336746	0.9833805	9.4502940	10.5497066	15
46	9.4341223	0.9833449	9.4507774	10.5492220	14
47	9.4345694	0.9833094	9.4512622	10.5487378	13
48	9.4350161	0.9832735	9.4517467	10.5482537	12
49	9.4354623	0.9832377	9.4522306	10.5477704	11
50	9.4359080	0.9832019	9.4527139	10.5472879	10
51	9.4363532	0.9831661	9.4531972	10.5468058	9
52	9.4367989	0.9831302	9.4536807	10.5463252	8
53	9.4372442	0.9830942	9.4541637	10.5458451	7
54	9.4376893	0.9830583	9.4546462	10.5453654	6
55	9.4381342	0.9830223	9.4551289	10.5448871	5
56	9.4385790	0.9829862	9.4556117	10.5444091	4
57	9.4390234	0.9829501	9.4560941	10.5439353	3
58	9.4394680	0.9829140	9.4565762	10.5434658	2
59	9.4399123	0.9828778	9.4570579	10.5429966	1
60	9.4403561	0.9828416	9.4575394	10.5425260	0
	Sine Comp.	Sine	Tan. Comp.	Tang.	Min.

74 Degrees

SINES AND TANGENTS.

173.

Min.	16 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4433381	9.9828416	9.4574964	10.5425036	63
1	9.4407784	9.9828054	9.4579370	10.5420270	59
2	9.4412182	9.9827691	9.4584491	10.5415599	58
3	9.4416576	9.9827328	9.4589612	10.5410752	57
4	9.4420965	9.9826966	9.4594701	10.5405915	56
5	9.4425349	9.9826604	9.4599749	10.5401121	55
6	9.4429728	9.9826242	9.4604842	10.5396308	54
7	9.4434103	9.9825871	9.4609932	10.5391478	53
8	9.4438477	9.9825506	9.4615020	10.5386633	52
9	9.4442837	9.9825140	9.4620107	10.5381783	51
10	9.4447197	9.9824774	9.4625193	10.5376927	50
11	9.4451553	9.9824408	9.4630274	10.5372055	49
12	9.4455904	9.9824041	9.4635353	10.5367178	48
13	9.4460250	9.9823674	9.4640430	10.5362295	47
14	9.4464591	9.9823306	9.4645505	10.5357405	46
15	9.4468927	9.9822938	9.4650578	10.5352509	45
16	9.4473259	9.9822569	9.4655649	10.5347607	44
17	9.4477586	9.9822201	9.4660718	10.5342699	43
18	9.4481909	9.9821831	9.4665785	10.5337785	42
19	9.4486227	9.9821462	9.4670849	10.5332865	41
20	9.4490540	9.9821092	9.4675911	10.5327939	40
21	9.4494849	9.9820721	9.4680970	10.5323007	39
22	9.4499153	9.9820351	9.4686027	10.5318069	38
23	9.4503452	9.9819979	9.4691082	10.5313125	37
24	9.4507747	9.9819608	9.4696135	10.5308175	36
25	9.4512037	9.9819236	9.4701187	10.5303219	35
26	9.4516322	9.9818863	9.4706237	10.5298257	34
27	9.4520603	9.9818490	9.4711285	10.5293289	33
28	9.4524879	9.9818117	9.4716331	10.5288315	32
29	9.4529151	9.9817744	9.4721375	10.5283335	31
30	9.4533418	9.9817370	9.4726417	10.5278349	30
31	9.4537681	9.9816995	9.4731458	10.5273357	29
32	9.4541939	9.9816620	9.4736497	10.5268359	28
33	9.4546192	9.9816245	9.4741534	10.5263355	27
34	9.4550441	9.9815870	9.4746569	10.5258345	26
35	9.4554686	9.9815494	9.4751602	10.5253329	25
36	9.4558926	9.9815117	9.4756633	10.5248307	24
37	9.4563161	9.9814740	9.4761662	10.5243279	23
38	9.4567392	9.9814363	9.4766689	10.5238245	22
39	9.4571618	9.9813986	9.4771714	10.5233205	21
40	9.4575840	9.9813608	9.4776738	10.5228159	20
41	9.4580058	9.9813229	9.4781760	10.5223107	19
42	9.4584271	9.9812850	9.4786781	10.5218049	18
43	9.4588480	9.9812471	9.4791799	10.5212985	17
44	9.4592684	9.9812091	9.4796815	10.5207915	16
45	9.4596884	9.9811711	9.4801829	10.5202839	15
46	9.4601079	9.9811331	9.4806841	10.5197757	14
47	9.4605270	9.9810950	9.4811851	10.5192669	13
48	9.4609456	9.9810569	9.4816859	10.5187575	12
49	9.4613638	9.9810187	9.4821865	10.5182475	11
50	9.4617816	9.9809805	9.4826869	10.5177369	10
51	9.4621989	9.9809423	9.4831871	10.5172257	9
52	9.4626158	9.9809040	9.4836871	10.5167139	8
53	9.4630323	9.9808657	9.4841869	10.5162015	7
54	9.4634483	9.9808273	9.4846865	10.5156885	6
55	9.4638639	9.9807889	9.4851859	10.5151749	5
56	9.4642790	9.9807505	9.4856851	10.5146607	4
57	9.4646938	9.9807120	9.4861841	10.5141459	3
58	9.4651081	9.9806735	9.4866829	10.5136305	2
59	9.4655219	9.9806349	9.4871815	10.5131145	1
60	9.4659353	9.9805963	9.4876799	10.5125979	0
Sine Comp.	Sine	Tang. Comp.	Tang.		Min.

73 Degrees

Min.	17 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4659353	9.9805963	9.4876799	10.5125979	60
1	9.4663483	9.9805577	9.4881785	10.5120815	59
2	9.4667609	9.9805190	9.4886769	10.5115645	58
3	9.4671730	9.9804803	9.4891751	10.5110470	57
4	9.4675848	9.9804415	9.4896733	10.5105295	56
5	9.4679959	9.9804027	9.4901714	10.5100120	55
6	9.4684069	9.9803639	9.4906695	10.5094945	54
7	9.4688173	9.9803250	9.4911675	10.5089769	53
8	9.4692273	9.9802860	9.4916654	10.5084593	52
9	9.4696369	9.9802471	9.4921632	10.5079416	51
10	9.4700461	9.9802081	9.4926609	10.5074238	50
11	9.4704548	9.9801690	9.4931586	10.5069059	49
12	9.4708631	9.9801299	9.4936561	10.5063878	48
13	9.4712710	9.9800908	9.4941537	10.5058694	47
14	9.4716785	9.9800516	9.4946511	10.5053508	46
15	9.4720856	9.9800124	9.4951484	10.5048321	45
16	9.4724922	9.9799732	9.4956456	10.5043132	44
17	9.4728989	9.9799339	9.4961427	10.5037941	43
18	9.4733043	9.9798946	9.4966397	10.5032748	42
19	9.4737097	9.9798552	9.4971366	10.5027553	41
20	9.4741146	9.9798158	9.4976334	10.5022356	40
21	9.4745192	9.9797764	9.4981299	10.5017157	39
22	9.4749234	9.9797369	9.4986261	10.5011956	38
23	9.4753271	9.9796973	9.4991221	10.5006753	37
24	9.4757304	9.9796578	9.4996179	10.5001548	36
25	9.4761334	9.9796182	9.5001134	10.4996341	35
26	9.4765359	9.9795785	9.5006115	10.4991132	34
27	9.4769380	9.9795388	9.5011094	10.4985921	33
28	9.4773396	9.9794991	9.5016070	10.4980708	32
29	9.4777409	9.9794593	9.5021043	10.4975493	31
30	9.4781418	9.9794195	9.5026014	10.4970276	30
31	9.4785423	9.9793796	9.5030983	10.4965057	29
32	9.4789423	9.9793395	9.5035949	10.4959836	28
33	9.4793420	9.9792998	9.5040912	10.4954613	27
34	9.4797412	9.9792599	9.5045872	10.4949388	26
35	9.4801401	9.9792198	9.5050829	10.4944161	25
36	9.4805388	9.9791797	9.5055783	10.4938932	24
37	9.4809366	9.9791395	9.5060734	10.4933691	23
38	9.4813344	9.9790990	9.5065682	10.4928448	22
39	9.4817313	9.9790584	9.5070627	10.4923203	21
40	9.4821281	9.9790179	9.5075569	10.4917956	20
41	9.4825248	9.9789778	9.5080509	10.4912707	19
42	9.4829205	9.9789376	9.5085445	10.4907456	18
43	9.4833161	9.9788973	9.5090378	10.4902203	17
44	9.4837117	9.9788569	9.5095308	10.4896948	16
45	9.4841066	9.9788165	9.5100235	10.4891691	15
46	9.4845010	9.9787760	9.5105159	10.4886432	14
47	9.4848951	9.9787355	9.5110080	10.4881171	13
48	9.4852888	9.9786950	9.5114998	10.4875908	12
49	9.4856822	9.9786545	9.5119913	10.4870643	11
50	9.4860749	9.9786140	9.5124825	10.4865376	10
51	9.4864674	9.9785734	9.5129734	10.4860107	9
52	9.4868591	9.9785328	9.5134640	10.4854836	8
53	9.4872507	9.9784921	9.5139543	10.4849563	7
54	9.4876420	9.9784515	9.5144443	10.4844288	6
55	9.4880335	9.9784111	9.5149340	10.4839011	5
56	9.4884240	9.9783702	9.5154234	10.4833732	4
57	9.4888142	9.9783293	9.5159125	10.4828451	3
58	9.4892040	9.9782883	9.5164013	10.4823168	2
59	9.4895934	9.9782474	9.5168900	10.4817882	1
60	9.4899824	9.9782063	9.5173784	10.4812594	0
Sine Comp.	Sine	Tang. Comp.	Tang.		Min.

72 Degrees

Min.	18 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.899824	9.9782062	9.5117760	10.4882240	60
1	9.9003710	9.9781653	9.5122257	10.4877943	59
2	9.9009192	9.9781241	9.5126751	10.4873649	58
3	9.9014671	9.9780830	9.5131241	10.4869359	57
4	9.9020154	9.9780418	9.5135727	10.4865073	56
5	9.9025636	9.9780006	9.5139210	10.4860792	55
6	9.9031119	9.9779593	9.5143690	10.4856510	54
7	9.9036606	9.9779180	9.5147766	10.4852234	53
8	9.9042085	9.9778766	9.5152239	10.4847961	52
9	9.9047561	9.9778353	9.5156309	10.4843691	51
10	9.9053035	9.9777938	9.5160357	10.4839425	50
11	9.9058501	9.9777523	9.5164398	10.4835162	49
12	9.9063969	9.9777108	9.5168937	10.4830903	48
13	9.9069430	9.9776693	9.5173353	10.4826647	47
14	9.9074883	9.9776277	9.5177606	10.4822394	46
15	9.9080339	9.9775860	9.5181855	10.4818145	45
16	9.9085795	9.9775441	9.5186101	10.4813894	44
17	9.9091250	9.9775026	9.5190344	10.4809653	43
18	9.9096709	9.9774609	9.5194583	10.4805417	42
19	9.9102169	9.9774191	9.5198819	10.4801181	41
20	9.9107624	9.9773772	9.5203042	10.4796940	40
21	9.9113083	9.9773354	9.5207282	10.4792718	39
22	9.9118542	9.9772934	9.5211508	10.4788492	38
23	9.9123999	9.9772515	9.5215730	10.4784270	37
24	9.9129459	9.9772095	9.5219950	10.4780050	36
25	9.9134910	9.9771674	9.5224166	10.4775834	35
26	9.9140363	9.9771253	9.5228374	10.4771621	34
27	9.9145817	9.9770832	9.5232589	10.4767411	33
28	9.9151270	9.9770410	9.5236795	10.4763203	32
29	9.9156725	9.9769988	9.5240999	10.4759001	31
30	9.9162179	9.9769566	9.5245199	10.4754801	30
31	9.9167635	9.9769143	9.5249395	10.4750605	29
32	9.9173090	9.9768720	9.5253589	10.4746411	28
33	9.9178546	9.9768296	9.5257779	10.4742221	27
34	9.9184003	9.9767872	9.5261966	10.4738034	26
35	9.9189459	9.9767447	9.5266150	10.4733850	25
36	9.9194916	9.9767022	9.5270331	10.4729669	24
37	9.9200373	9.9766597	9.5274508	10.4725492	23
38	9.9205830	9.9766171	9.5278682	10.4721318	22
39	9.9211287	9.9765745	9.5282853	10.4717147	21
40	9.9216744	9.9765318	9.5287021	10.4712970	20
41	9.9222201	9.9764891	9.5291186	10.4708814	19
42	9.9227658	9.9764464	9.5295347	10.4704653	18
43	9.9233115	9.9764036	9.5299505	10.4700495	17
44	9.9238572	9.9763608	9.5303661	10.4696339	16
45	9.9244029	9.9763179	9.5307813	10.4692187	15
46	9.9249486	9.9762750	9.5311961	10.4688039	14
47	9.9254943	9.9762321	9.5316107	10.4683893	13
48	9.9260400	9.9761891	9.5320250	10.4679750	12
49	9.9265857	9.9761461	9.5324389	10.4675611	11
50	9.9271314	9.9761030	9.5328526	10.4671474	10
51	9.9276771	9.9760599	9.5332659	10.4667341	9
52	9.9282228	9.9760167	9.5336789	10.4663211	8
53	9.9287685	9.9759736	9.5340916	10.4659084	7
54	9.9293142	9.9759303	9.5345040	10.4654950	6
55	9.9298599	9.9758870	9.5349161	10.4650819	5
56	9.9304056	9.9758437	9.5353278	10.4646682	4
57	9.9309513	9.9758004	9.5357393	10.4642547	3
58	9.9314970	9.9757570	9.5361505	10.4638415	2
59	9.9320427	9.9757135	9.5365613	10.4634287	1
60	9.9325884	9.9756701	9.5369719	10.4630281	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	

71 Degrees

Min.	19 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.9126419	9.9756710	9.5369718	10.4630282	60
1	9.9131876	9.9756265	9.5373821	10.4626129	59
2	9.9137333	9.9755830	9.5377920	10.4621080	58
3	9.9142790	9.9755394	9.5382017	10.4617983	57
4	9.9148247	9.9754957	9.5386110	10.4613890	56
5	9.9153704	9.9754521	9.5390200	10.4609800	55
6	9.9159161	9.9754083	9.5394287	10.4605713	54
7	9.9164618	9.9753646	9.5398371	10.4601629	53
8	9.9170075	9.9753209	9.5402453	10.4597545	52
9	9.9175532	9.9752772	9.5406531	10.4593460	51
10	9.9180989	9.9752330	9.5410606	10.4589374	50
11	9.9186446	9.9751891	9.5414678	10.4585289	49
12	9.9191903	9.9751451	9.5418747	10.4581203	48
13	9.9197360	9.9751011	9.5422813	10.4577117	47
14	9.9202817	9.9750570	9.5426877	10.4573031	46
15	9.9208274	9.9750129	9.5430937	10.4568945	45
16	9.9213731	9.9749688	9.5434994	10.4564859	44
17	9.9219188	9.9749246	9.5439049	10.4560772	43
18	9.9224645	9.9748804	9.5443100	10.4556686	42
19	9.9230102	9.9748361	9.5447148	10.4552598	41
20	9.9235559	9.9747918	9.5451193	10.4548510	40
21	9.9241016	9.9747475	9.5455236	10.4544424	39
22	9.9246473	9.9747031	9.5459276	10.4540338	38
23	9.9251930	9.9746587	9.5463312	10.4536253	37
24	9.9257387	9.9746142	9.5467346	10.4532167	36
25	9.9262844	9.9745697	9.5471377	10.4528082	35
26	9.9268301	9.9745252	9.5475403	10.4524000	34
27	9.9273758	9.9744806	9.5479429	10.4520000	33
28	9.9279215	9.9744359	9.5483452	10.4516000	32
29	9.9284672	9.9743913	9.5487477	10.4512000	31
30	9.9290129	9.9743466	9.5491487	10.4508000	30
31	9.9295586	9.9743018	9.5495500	10.4504000	29
32	9.9301043	9.9742570	9.5499511	10.4500000	28
33	9.9306500	9.9742122	9.5503523	10.4496000	27
34	9.9311957	9.9741673	9.5507523	10.4492000	26
35	9.9317414	9.9741224	9.5511524	10.4488000	25
36	9.9322871	9.9740774	9.5515525	10.4484000	24
37	9.9328328	9.9740324	9.5519521	10.4480000	23
38	9.9333785	9.9739873	9.5523523	10.4476000	22
39	9.9339242	9.9739422	9.5527524	10.4472000	21
40	9.9344699	9.9738971	9.5531492	10.4468000	20
41	9.9350156	9.9738521	9.5535477	10.4464000	19
42	9.9355613	9.9738067	9.5539459	10.4460000	18
43	9.9361070	9.9737613	9.5543438	10.4456000	17
44	9.9366527	9.9737162	9.5547415	10.4452000	16
45	9.9371984	9.9736709	9.5551388	10.4448000	15
46	9.9377441	9.9736255	9.5555359	10.4444000	14
47	9.9382898	9.9735801	9.5559329	10.4440000	13
48	9.9388355	9.9735346	9.5563297	10.4436000	12
49	9.9393812	9.9734891	9.5567255	10.4432000	11
50	9.9399269	9.9734435	9.5571211	10.4428000	10
51	9.9404726	9.9733980	9.5575171	10.4424000	9
52	9.9410183	9.9733525	9.5579125	10.4420000	8
53	9.9415640	9.9733067	9.5583077	10.4416000	7
54	9.9421097	9.9732610	9.5587025	10.4412000	6
55	9.9426554	9.9732152	9.5590971	10.4408000	5
56	9.9432011	9.9731694	9.5594914	10.4404000	4
57	9.9437468	9.9731236	9.5598854	10.4400000	3
58	9.9442925	9.9730777	9.5602792	10.4396000	2
59	9.9448382	9.9730318	9.5606727	10.4392000	1
60	9.9453839	9.9729858	9.5610650	10.4388000	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	

70 Degrees

SINES AND TANGENTS.

175

20 Degrees.				
Min.	Sine	Sine Comp.	Tang.	Tang. Comp.
0	9.5340517	9.9729858	9.5610559	10.4389341
1	9.5343986	9.9729398	9.5614588	10.4385412
2	9.5347452	9.9728938	9.5618515	10.4381485
3	9.5350915	9.9728477	9.5622439	10.4377561
4	9.5354375	9.9728016	9.5626366	10.4373636
5	9.5357834	9.9727554	9.5630287	10.4369722
6	9.5361286	9.9727092	9.5634194	10.4365806
7	9.5364737	9.9726629	9.5638101	10.4361893
8	9.5368184	9.9726166	9.5642018	10.4357982
9	9.5371628	9.9725703	9.5645925	10.4354075
10	9.5375070	9.9725239	9.5649831	10.4350169
11	9.5378508	9.9724775	9.5653733	10.4346267
12	9.5381943	9.9724310	9.5657633	10.4342367
13	9.5385375	9.9723845	9.5661530	10.4338467
14	9.5388804	9.9723380	9.5665424	10.4334566
15	9.5392230	9.9722914	9.5669316	10.4330664
16	9.5395653	9.9722448	9.5673205	10.4326761
17	9.5399073	9.9721981	9.5677091	10.4322859
18	9.5402489	9.9721514	9.5680975	10.4318952
19	9.5405903	9.9721047	9.5684855	10.4315044
20	9.5409314	9.9720579	9.5688735	10.4311136
21	9.5412721	9.9720110	9.5692611	10.4307229
22	9.5416126	9.9719642	9.5696484	10.4303316
23	9.5419527	9.9719172	9.5700355	10.4299403
24	9.5422926	9.9718703	9.5704223	10.4295489
25	9.5426321	9.9718233	9.5708088	10.4291572
26	9.5429713	9.9717762	9.5711951	10.4287654
27	9.5433103	9.9717291	9.5715811	10.4283733
28	9.5436489	9.9716820	9.5719669	10.4279811
29	9.5439873	9.9716348	9.5723523	10.4275888
30	9.5443253	9.9715876	9.5727377	10.4271963
31	9.5446630	9.9715404	9.5731227	10.4268037
32	9.5450003	9.9714931	9.5735074	10.4264109
33	9.5453377	9.9714457	9.5738919	10.4260181
34	9.5456745	9.9713984	9.5742761	10.4256253
35	9.5460110	9.9713509	9.5746601	10.4252323
36	9.5463472	9.9713035	9.5750438	10.4248392
37	9.5466832	9.9712560	9.5754272	10.4244458
38	9.5470189	9.9712084	9.5758104	10.4240522
39	9.5473542	9.9711608	9.5761934	10.4236584
40	9.5476893	9.9711132	9.5765761	10.4232643
41	9.5480240	9.9710655	9.5769595	10.4228701
42	9.5483584	9.9710178	9.5773427	10.4224756
43	9.5486927	9.9709700	9.5777256	10.4220811
44	9.5490266	9.9709223	9.5781084	10.4216864
45	9.5493602	9.9708744	9.5784913	10.4212916
46	9.5496933	9.9708265	9.5788739	10.4208966
47	9.5500265	9.9707786	9.5792567	10.4205014
48	9.5503592	9.9707305	9.5796392	10.4201061
49	9.5506916	9.9706826	9.5800216	10.4197106
50	9.5510237	9.9706345	9.5803982	10.4193148
51	9.5513556	9.9705865	9.5807791	10.4189189
52	9.5516871	9.9705383	9.5811598	10.4185228
53	9.5520184	9.9704902	9.5815382	10.4181265
54	9.5523494	9.9704419	9.5819167	10.4177301
55	9.5526801	9.9703937	9.5822864	10.4173334
56	9.5530106	9.9703454	9.5826561	10.4169366
57	9.5533406	9.9702970	9.5830253	10.4165396
58	9.5536704	9.9702486	9.5833941	10.4161424
59	9.5539999	9.9702002	9.5837627	10.4157450
60	9.5543292	9.9701517	9.5841311	10.4153474

21 Degrees.				
Min.	Sine	Sine Comp.	Tang.	Tang. Comp.
0	9.5543292	9.9701517	9.5841311	10.4153474
1	9.5546581	9.9701032	9.5845000	10.4149495
2	9.5549868	9.9700547	9.5848684	10.4145514
3	9.5553152	9.9700061	9.5852369	10.4141531
4	9.5556433	9.9699574	9.5856054	10.4137546
5	9.5559711	9.9699087	9.5859738	10.4133559
6	9.5562987	9.9698600	9.5863423	10.4129569
7	9.5566262	9.9698112	9.5867107	10.4125577
8	9.5569539	9.9697624	9.5870791	10.4121583
9	9.5572813	9.9697136	9.5874475	10.4117588
10	9.5576086	9.9696647	9.5878158	10.4113591
11	9.5579357	9.9696158	9.5881841	10.4109593
12	9.5582627	9.9695668	9.5885523	10.4105593
13	9.5585895	9.9695177	9.5889205	10.4101591
14	9.5589162	9.9694687	9.5892886	10.4097588
15	9.5592428	9.9694196	9.5896567	10.4093583
16	9.5595693	9.9693704	9.5900247	10.4089576
17	9.5598957	9.9693212	9.5903926	10.4085568
18	9.5602219	9.9692720	9.5907604	10.4081558
19	9.5605480	9.9692227	9.5911281	10.4077546
20	9.5608739	9.9691734	9.5914957	10.4073533
21	9.5611997	9.9691241	9.5918632	10.4069518
22	9.5615254	9.9690746	9.5922306	10.4065501
23	9.5618509	9.9690252	9.5925979	10.4061483
24	9.5621762	9.9689757	9.5929651	10.4057463
25	9.5625014	9.9689262	9.5933323	10.4053441
26	9.5628264	9.9688766	9.5936994	10.4049418
27	9.5631512	9.9688270	9.5940665	10.4045393
28	9.5634759	9.9687773	9.5944335	10.4041367
29	9.5638004	9.9687276	9.5948004	10.4037339
30	9.5641247	9.9686779	9.5951673	10.4033309
31	9.5644489	9.9686281	9.5955341	10.4029277
32	9.5647729	9.9685783	9.5959009	10.4025243
33	9.5650968	9.9685284	9.5962676	10.4021208
34	9.5654205	9.9684785	9.5966343	10.4017172
35	9.5657441	9.9684286	9.5969999	10.4013134
36	9.5660676	9.9683786	9.5973654	10.4009094
37	9.5663909	9.9683285	9.5977309	10.4005052
38	9.5667141	9.9682784	9.5980963	10.4001008
39	9.5670372	9.9682283	9.5984617	10.3996962
40	9.5673602	9.9681781	9.5988270	10.3992914
41	9.5676831	9.9681279	9.5991922	10.3988864
42	9.5679999	9.9680777	9.5995574	10.3984812
43	9.5683166	9.9680274	9.5999226	10.3980758
44	9.5686331	9.9679771	9.6002877	10.3976701
45	9.5689495	9.9679267	9.6006527	10.3972643
46	9.5692658	9.9678763	9.6010177	10.3968583
47	9.5695819	9.9678258	9.6013826	10.3964521
48	9.5698979	9.9677753	9.6017474	10.3960457
49	9.5702138	9.9677247	9.6021121	10.3956391
50	9.5705295	9.9676741	9.6024767	10.3952322
51	9.5708451	9.9676235	9.6028412	10.3948251
52	9.5711606	9.9675728	9.6032057	10.3944177
53	9.5714760	9.9675221	9.6035701	10.3940101
54	9.5717913	9.9674713	9.6039344	10.3936023
55	9.5721066	9.9674205	9.6042987	10.3931944
56	9.5724218	9.9673697	9.6046629	10.3927863
57	9.5727369	9.9673189	9.6050271	10.3923779
58	9.5730519	9.9672681	9.6053912	10.3919693
59	9.5733668	9.9672172	9.6057553	10.3915605
60	9.5736816	9.9671663	9.6061193	10.3911515

Sine Comp. Sine Tang. Comp. Tang. Min.

60 Degrees.

Sine Comp. Sine Tang. Comp. Tang. Min.

68 Degrees.

Min.	22 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.5735754	9.9671659	9.6064096	10.3935904	60
1	9.5738880	9.9671148	9.6067732	10.3932268	59
2	9.5742003	9.9670637	9.6071360	10.3928634	58
3	9.5745123	9.9670125	9.6074997	10.3925003	57
4	9.5748240	9.9669614	9.6078624	10.3921373	56
5	9.5751355	9.9669101	9.6082254	10.3917740	55
6	9.5754468	9.9668588	9.6085880	10.3914120	54
7	9.5757578	9.9668075	9.6089503	10.3910497	53
8	9.5760688	9.9667562	9.6093124	10.3906876	52
9	9.5763799	9.9667048	9.6096744	10.3903258	51
10	9.5766892	9.9666533	9.6100359	10.3899641	50
11	9.5769991	9.9666018	9.6103973	10.3896027	49
12	9.5773088	9.9665503	9.6107580	10.3892414	48
13	9.5776183	9.9664986	9.6111196	10.3888804	47
14	9.5779275	9.9664470	9.6114804	10.3885196	46
15	9.5782364	9.9663954	9.6118409	10.3881591	45
16	9.5785450	9.9663437	9.6122013	10.3877987	44
17	9.5788533	9.9662920	9.6125615	10.3874385	43
18	9.5791616	9.9662402	9.6129214	10.3870786	42
19	9.5794695	9.9661884	9.6132812	10.3867188	41
20	9.5797772	9.9661365	9.6136407	10.3863593	40
21	9.5800845	9.9660846	9.6140000	10.3860000	39
22	9.5803917	9.9660326	9.6143591	10.3856409	38
23	9.5806986	9.9659806	9.6147180	10.3852820	37
24	9.5810052	9.9659285	9.6150766	10.3849234	36
25	9.5813116	9.9658764	9.6154351	10.3845649	35
26	9.5816177	9.9658243	9.6157934	10.3842060	34
27	9.5819236	9.9657721	9.6161514	10.3838486	33
28	9.5822292	9.9657199	9.6165093	10.3834907	32
29	9.5825345	9.9656677	9.6168669	10.3831331	31
30	9.5828397	9.9656153	9.6172243	10.3827757	30
31	9.5831445	9.9655630	9.6175815	10.3824183	29
32	9.5834491	9.9655106	9.6179386	10.3820615	28
33	9.5837535	9.9654582	9.6182953	10.3817047	27
34	9.5840576	9.9654057	9.6186519	10.3813481	26
35	9.5843615	9.9653532	9.6190080	10.3809917	25
36	9.5846651	9.9653006	9.6193643	10.3806355	24
37	9.5849685	9.9652480	9.6197205	10.3802793	23
38	9.5852716	9.9651953	9.6200766	10.3799232	22
39	9.5855745	9.9651426	9.6204318	10.3795672	21
40	9.5858771	9.9650899	9.6207872	10.3792120	20
41	9.5861795	9.9650371	9.6211427	10.3788577	19
42	9.5864816	9.9649843	9.6214974	10.3785026	18
43	9.5867835	9.9649314	9.6218522	10.3781480	17
44	9.5870851	9.9648785	9.6222066	10.3777934	16
45	9.5873865	9.9648256	9.6225609	10.3774391	15
46	9.5876876	9.9647726	9.6229151	10.3770850	14
47	9.5879885	9.9647195	9.6232693	10.3767310	13
48	9.5882892	9.9646665	9.6236227	10.3763773	12
49	9.5885896	9.9646133	9.6239763	10.3760237	11
50	9.5888897	9.9645602	9.6243296	10.3756704	10
51	9.5891897	9.9645069	9.6246827	10.3753173	9
52	9.5894893	9.9644537	9.6250356	10.3749644	8
53	9.5897885	9.9644004	9.6253884	10.3746116	7
54	9.5900880	9.9643470	9.6257409	10.3742591	6
55	9.5903869	9.9642937	9.6260934	10.3739068	5
56	9.5906855	9.9642402	9.6264454	10.3735548	4
57	9.5909841	9.9641868	9.6267973	10.3732027	3
58	9.5912823	9.9641333	9.6271491	10.3728509	2
59	9.5915803	9.9640797	9.6275006	10.3724994	1
60	9.5918780	9.9640261	9.6278519	10.3721481	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

Min.	23 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.5918780	9.9640261	9.6278519	10.3721481	60
1	9.5921755	9.9639724	9.6282031	10.3719969	59
2	9.5924728	9.9639187	9.6285540	10.3718460	58
3	9.5927698	9.9638650	9.6289048	10.3716952	57
4	9.5930666	9.9638112	9.6292553	10.3715445	56
5	9.5933631	9.9637574	9.6296057	10.3713939	55
6	9.5936594	9.9637036	9.6299558	10.3712434	54
7	9.5939555	9.9636496	9.6303058	10.3710929	53
8	9.5942513	9.9635957	9.6306556	10.3709424	52
9	9.5945469	9.9635417	9.6310052	10.3707919	51
10	9.5948422	9.9634877	9.6313545	10.3706415	50
11	9.5951373	9.9634336	9.6317037	10.3704910	49
12	9.5954322	9.9633795	9.6320527	10.3703407	48
13	9.5957268	9.9633253	9.6324015	10.3701903	47
14	9.5960212	9.9632711	9.6327501	10.3700399	46
15	9.5963154	9.9632168	9.6330985	10.3698895	45
16	9.5966093	9.9631625	9.6334468	10.3697392	44
17	9.5969030	9.9631082	9.6337948	10.3695889	43
18	9.5971965	9.9630538	9.6341426	10.3694387	42
19	9.5974897	9.9630000	9.6344903	10.3692884	41
20	9.5977827	9.9629449	9.6348378	10.3691382	40
21	9.5980754	9.9628904	9.6351852	10.3689880	39
22	9.5983679	9.9628358	9.6355321	10.3688378	38
23	9.5986602	9.9627812	9.6358790	10.3686876	37
24	9.5989523	9.9627263	9.6362257	10.3685373	36
25	9.5992441	9.9626719	9.6365722	10.3683870	35
26	9.5995357	9.9626172	9.6369185	10.3682368	34
27	9.5998271	9.9625624	9.6372646	10.3680865	33
28	9.6001181	9.9625076	9.6376106	10.3679362	32
29	9.6004090	9.9624527	9.6379563	10.3677859	31
30	9.6006997	9.9623978	9.6383019	10.3676356	30
31	9.6009901	9.9623429	9.6386473	10.3674853	29
32	9.6012803	9.9622878	9.6389925	10.3673350	28
33	9.6015703	9.9622328	9.6393375	10.3671847	27
34	9.6018600	9.9621777	9.6396823	10.3670344	26
35	9.6021495	9.9621226	9.6400269	10.3668841	25
36	9.6024388	9.9620674	9.6403714	10.3667338	24
37	9.6027278	9.9620121	9.6407156	10.3665835	23
38	9.6030166	9.9619560	9.6410597	10.3664332	22
39	9.6033052	9.9619016	9.6414036	10.3662829	21
40	9.6035936	9.9618463	9.6417473	10.3661326	20
41	9.6038817	9.9617909	9.6420908	10.3659823	19
42	9.6041696	9.9617355	9.6424342	10.3658320	18
43	9.6044573	9.9616800	9.6427773	10.3656817	17
44	9.6047448	9.9616245	9.6431203	10.3655314	16
45	9.6050322	9.9615689	9.6434631	10.3653811	15
46	9.6053195	9.9615133	9.6438056	10.3652308	14
47	9.6056065	9.9614576	9.6441481	10.3650805	13
48	9.6058923	9.9614020	9.6444903	10.3649302	12
49	9.6061780	9.9613463	9.6448324	10.3647799	11
50	9.6064647	9.9612904	9.6451743	10.3646296	10
51	9.6067500	9.9612345	9.6455160	10.3644793	9
52	9.6070362	9.9611787	9.6458575	10.3643290	8
53	9.6073216	9.9611228	9.6461988	10.3641787	7
54	9.6076068	9.9610668	9.6465400	10.3640284	6
55	9.6078918	9.9610108	9.6468811	10.3638781	5
56	9.6081765	9.9609548	9.6472227	10.3637278	4
57	9.6084611	9.9608987	9.6475642	10.3635775	3
58	9.6087454	9.9608426	9.6479058	10.3634272	2
59	9.6090294	9.9607864	9.6482471	10.3632769	1
60	9.6093133	9.9607302	9.6485883	10.3631266	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

Min.	24 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Com.	
0	9.609313	9.9607302	9.6485831	10.3514169	60
1	9.6095969	9.9606739	9.6489230	10.3510770	59
2	9.6098803	9.9606179	9.6492628	10.3507372	58
3	9.6101635	9.9605612	9.6496023	10.3503977	57
4	9.6104465	9.9605048	9.6499417	10.3500583	56
5	9.6107293	9.9604484	9.6502809	10.3497191	55
6	9.6110118	9.9603919	9.6506197	10.3493801	54
7	9.6112941	9.9603354	9.6509587	10.3490413	53
8	9.6115762	9.9602788	9.6512974	10.3487026	52
9	9.6118581	9.9602222	9.6516359	10.3483641	51
10	9.6121397	9.9601655	9.6519742	10.3480258	50
11	9.6124211	9.9601088	9.6523123	10.3476877	49
12	9.6127023	9.9600520	9.6526503	10.3473497	48
13	9.6129833	9.9599952	9.6529881	10.3470119	47
14	9.6132641	9.9599384	9.6533257	10.3466743	46
15	9.6135446	9.9598815	9.6536633	10.3463369	45
16	9.6138250	9.9598246	9.6540004	10.3459996	44
17	9.6141051	9.9597676	9.6543375	10.3456625	43
18	9.6143855	9.9597106	9.6546744	10.3453256	42
19	9.6146664	9.9596535	9.6550112	10.3449884	41
20	9.6149461	9.9595964	9.6553477	10.3446513	40
21	9.6152234	9.9595393	9.6556841	10.3443139	39
22	9.6155024	9.9594821	9.6560204	10.3439766	38
23	9.6157812	9.9594248	9.6563564	10.3436393	37
24	9.6160598	9.9593675	9.6566923	10.3433027	36
25	9.6163382	9.9593102	9.6570280	10.3429655	35
26	9.6166164	9.9592528	9.6573636	10.3426284	34
27	9.6168944	9.9591954	9.6576989	10.3422911	33
28	9.6171721	9.9591381	9.6580341	10.3419539	32
29	9.6174496	9.9590805	9.6583692	10.3416168	31
30	9.6177271	9.9590229	9.6587041	10.3412796	30
31	9.6180045	9.9589653	9.6590387	10.3409421	29
32	9.6182809	9.9589077	9.6593733	10.3406046	28
33	9.6185576	9.9588500	9.6597076	10.3402672	27
34	9.6188341	9.9587923	9.6600418	10.3399298	26
35	9.6191104	9.9587345	9.6603758	10.3395924	25
36	9.6193866	9.9586767	9.6607093	10.3392550	24
37	9.6196622	9.9586188	9.6610430	10.3389176	23
38	9.6199378	9.9585609	9.6613760	10.3385801	22
39	9.6202132	9.9585030	9.6617103	10.3382427	21
40	9.6204884	9.9584450	9.6620434	10.3379052	20
41	9.6207634	9.9583869	9.6623765	10.3375677	19
42	9.6210382	9.9583288	9.6627093	10.3372302	18
43	9.6213127	9.9582707	9.6630423	10.3368927	17
44	9.6215871	9.9582125	9.6633745	10.3365551	16
45	9.6218612	9.9581543	9.6637069	10.3362175	15
46	9.6221351	9.9580961	9.6640391	10.3358800	14
47	9.6224088	9.9580378	9.6643711	10.3355425	13
48	9.6226824	9.9579794	9.6647030	10.3352050	12
49	9.6229557	9.9579210	9.6650346	10.3348675	11
50	9.6232287	9.9578626	9.6653662	10.3345300	10
51	9.6235016	9.9578041	9.6656977	10.3341925	9
52	9.6237743	9.9577455	9.6660288	10.3338550	8
53	9.6240467	9.9576870	9.6663598	10.3335175	7
54	9.6243190	9.9576284	9.6666909	10.3331800	6
55	9.6245911	9.9575697	9.6670214	10.3328425	5
56	9.6248629	9.9575110	9.6673519	10.3325050	4
57	9.6251343	9.9574524	9.6676821	10.3321675	3
58	9.6254060	9.9573937	9.6680126	10.3318300	2
59	9.6256772	9.9573349	9.6683426	10.3314925	1
60	9.6259483	9.9572757	9.6686725	10.3311550	0
	Sine	Sine	Tang. Com.	Tang.	Min.

65 Degrees

Min.	25 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Com.	
0	9.6259483	9.9572757	9.6686725	10.3311550	60
1	9.6262191	9.9572168	9.6690023	10.3308175	59
2	9.6264897	9.9571578	9.6693310	10.3304800	58
3	9.6267601	9.9570988	9.6696606	10.3301425	57
4	9.6270303	9.9570397	9.6699906	10.3298050	56
5	9.6273003	9.9569806	9.6703197	10.3294675	55
6	9.6275701	9.9569215	9.6706488	10.3291300	54
7	9.6278397	9.9568623	9.6709774	10.3287925	53
8	9.6281090	9.9568030	9.6713060	10.3284550	52
9	9.6283782	9.9567437	9.6716345	10.3281175	51
10	9.6286472	9.9566844	9.6719628	10.3277800	50
11	9.6289160	9.9566250	9.6722910	10.3274425	49
12	9.6291845	9.9565656	9.6726190	10.3271050	48
13	9.6294529	9.9565061	9.6729468	10.3267675	47
14	9.6297211	9.9564466	9.6732745	10.3264300	46
15	9.6299890	9.9563870	9.6736020	10.3260925	45
16	9.6302568	9.9563274	9.6739294	10.3257550	44
17	9.6305243	9.9562678	9.6742566	10.3254175	43
18	9.6307917	9.9562081	9.6745836	10.3250800	42
19	9.6310589	9.9561483	9.6749103	10.3247425	41
20	9.6313258	9.9560886	9.6752372	10.3244050	40
21	9.6315926	9.9560287	9.6755638	10.3240675	39
22	9.6318591	9.9559689	9.6758903	10.3237300	38
23	9.6321255	9.9559090	9.6762166	10.3233925	37
24	9.6323916	9.9558490	9.6765426	10.3230550	36
25	9.6326576	9.9557890	9.6768686	10.3227175	35
26	9.6329233	9.9557289	9.6771944	10.3223800	34
27	9.6331889	9.9556688	9.6775201	10.3220425	33
28	9.6334542	9.9556087	9.6778456	10.3217050	32
29	9.6337194	9.9555485	9.6781709	10.3213675	31
30	9.6339844	9.9554882	9.6784961	10.3210300	30
31	9.6342491	9.9554280	9.6788211	10.3206925	29
32	9.6345137	9.9553676	9.6791460	10.3203550	28
33	9.6347780	9.9553073	9.6794708	10.3200175	27
34	9.6350422	9.9552469	9.6797953	10.3196800	26
35	9.6353062	9.9551864	9.6801188	10.3193425	25
36	9.6355699	9.9551259	9.6804440	10.3190050	24
37	9.6358335	9.9550653	9.6807682	10.3186675	23
38	9.6360969	9.9550047	9.6810921	10.3183300	22
39	9.6363601	9.9549441	9.6814160	10.3179925	21
40	9.6366231	9.9548834	9.6817396	10.3176550	20
41	9.6368859	9.9548227	9.6820634	10.3173175	19
42	9.6371481	9.9547619	9.6823865	10.3169800	18
43	9.6374108	9.9547011	9.6827097	10.3166425	17
44	9.6376731	9.9546402	9.6830328	10.3163050	16
45	9.6379351	9.9545793	9.6833557	10.3159675	15
46	9.6381969	9.9545184	9.6836785	10.3156300	14
47	9.6384585	9.9544574	9.6840011	10.3152925	13
48	9.6387199	9.9543963	9.6843236	10.3149550	12
49	9.6389812	9.9543352	9.6846459	10.3146175	11
50	9.6392422	9.9542741	9.6849681	10.3142800	10
51	9.6395030	9.9542129	9.6852901	10.3139425	9
52	9.6397637	9.9541517	9.6856120	10.3136050	8
53	9.6400241	9.9540904	9.6859338	10.3132675	7
54	9.6402844	9.9540291	9.6862553	10.3129300	6
55	9.6405445	9.9539677	9.6865767	10.3125925	5
56	9.6408044	9.9539063	9.6868981	10.3122550	4
57	9.6410640	9.9538448	9.6872192	10.3119175	3
58	9.6413235	9.9537833	9.6875402	10.3115800	2
59	9.6415828	9.9537218	9.6878611	10.3112425	1
60	9.6418422	9.9536602	9.6881818	10.3109050	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

64 Degrees

Min.	26 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.6418420	9.9536602	9.6881818	10.3118182	60
1	9.6421009	9.9535985	9.68855023	10.3114977	59
2	9.6423596	9.9535369	9.6888227	10.3111773	58
3	9.6426182	9.9534751	9.6891430	10.3108573	57
4	9.6428765	9.9534134	9.6894631	10.3105369	56
5	9.6431347	9.9533515	9.6897830	10.3102169	55
6	9.6433926	9.9532897	9.6901031	10.3098970	54
7	9.6436504	9.9532278	9.6904226	10.3095774	53
8	9.6439080	9.9531658	9.6907422	10.3092578	52
9	9.6441654	9.9531038	9.6910616	10.3089384	51
10	9.6444226	9.9530418	9.6913813	10.3086191	50
11	9.6446796	9.9529797	9.6917000	10.3083000	49
12	9.6449365	9.9529175	9.6920189	10.3079811	48
13	9.6451931	9.9528553	9.6923378	10.3076622	47
14	9.6454496	9.9527931	9.6926565	10.3073435	46
15	9.6457058	9.9527308	9.6929750	10.3070250	45
16	9.6459619	9.9526685	9.6932934	10.3067066	44
17	9.6462178	9.9526061	9.6936117	10.3063883	43
18	9.6464735	9.9525437	9.6939298	10.3060702	42
19	9.6467290	9.9524813	9.6942478	10.3057522	41
20	9.6469844	9.9524188	9.6945656	10.3054344	40
21	9.6472395	9.9523562	9.6948833	10.3051167	39
22	9.6474945	9.9522936	9.6952009	10.3047991	38
23	9.6477492	9.9522310	9.6955189	10.3044817	37
24	9.6480038	9.9521683	9.6958355	10.3041645	36
25	9.6482582	9.9521055	9.6961527	10.3038473	35
26	9.6485124	9.9520428	9.6964697	10.3035303	34
27	9.6487665	9.9519799	9.6967863	10.3032135	33
28	9.6490203	9.9519171	9.6971032	10.3028968	32
29	9.6492740	9.9518541	9.6974198	10.3025802	31
30	9.6495274	9.9517912	9.6977363	10.3022637	30
31	9.6497807	9.9517282	9.6980526	10.3019474	29
32	9.6500338	9.9516651	9.6983687	10.3016311	28
33	9.6502868	9.9516020	9.6986843	10.3013153	27
34	9.6505395	9.9515389	9.6990000	10.3009994	26
35	9.6507920	9.9514757	9.6993164	10.3006836	25
36	9.6510442	9.9514124	9.6996320	10.3003680	24
37	9.6512966	9.9513492	9.6999474	10.3000526	23
38	9.6515486	9.9512858	9.7002628	10.2997372	22
39	9.6518004	9.9512224	9.7005780	10.2994220	21
40	9.6520521	9.9511591	9.7008933	10.2991070	20
41	9.6523035	9.9510956	9.7012080	10.2987920	19
42	9.6525548	9.9510320	9.7015227	10.2984773	18
43	9.6528059	9.9509683	9.7018374	10.2981626	17
44	9.6530568	9.9509040	9.7021519	10.2978481	16
45	9.6533075	9.9508392	9.7024663	10.2975337	15
46	9.6535581	9.9507745	9.7027805	10.2972195	14
47	9.6538084	9.9507097	9.7030946	10.2969054	13
48	9.6540584	9.9506450	9.7034086	10.2965914	12
49	9.6543086	9.9505801	9.7037225	10.2962775	11
50	9.6545584	9.9505153	9.7040362	10.2959638	10
51	9.6548081	9.9504503	9.7043497	10.2956503	9
52	9.6550575	9.9503854	9.7046632	10.2953368	8
53	9.6553068	9.9503203	9.7049765	10.2950235	7
54	9.6555559	9.9502553	9.7052897	10.2947103	6
55	9.6558048	9.9501902	9.7056027	10.2943973	5
56	9.6560536	9.9501250	9.7059156	10.2940844	4
57	9.6563021	9.9500598	9.7062284	10.2937716	3
58	9.6565505	9.9500000	9.7065410	10.2934590	2
59	9.6567987	9.9499452	9.7068535	10.2931465	1
60	9.6570468	9.9498809	9.7071659	10.2928341	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

63 Degrees

Min.	27 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.6570468	9.9498809	9.7071659	10.2928341	60
1	9.6572946	9.9498165	9.7074781	10.2925219	59
2	9.6575423	9.9497521	9.7077902	10.2922098	58
3	9.6577898	9.9496876	9.7081022	10.2918978	57
4	9.6580371	9.9496230	9.7084141	10.2915859	56
5	9.6582842	9.9495585	9.7087261	10.2912735	55
6	9.6585313	9.9494938	9.7090379	10.2909606	54
7	9.6587788	9.9494292	9.7093488	10.2906472	53
8	9.6590246	9.9493645	9.7096601	10.2903339	52
9	9.6592710	9.9492997	9.7099713	10.2900207	51
10	9.6595173	9.9492349	9.7102824	10.2897076	50
11	9.6597634	9.9491700	9.7105933	10.2893946	49
12	9.6600093	9.9491051	9.7109041	10.2890815	48
13	9.6602550	9.9490402	9.7112148	10.2887685	47
14	9.6605005	9.9489752	9.7115254	10.2884546	46
15	9.6607460	9.9489101	9.7118358	10.2881402	45
16	9.6609911	9.9488450	9.7121461	10.2878259	44
17	9.6612361	9.9487799	9.7124562	10.2875118	43
18	9.6614810	9.9487147	9.7127662	10.2871973	42
19	9.6617257	9.9486495	9.7130761	10.2868831	41
20	9.6619702	9.9485842	9.7133859	10.2865681	40
21	9.6622145	9.9485189	9.7136956	10.2862534	39
22	9.6624586	9.9484535	9.7140051	10.2859389	38
23	9.6627026	9.9483881	9.7143145	10.2856245	37
24	9.6629464	9.9483227	9.7146237	10.2853103	36
25	9.6631900	9.9482572	9.7149329	10.2850011	35
26	9.6634335	9.9481916	9.7152419	10.2846871	34
27	9.6636768	9.9481260	9.7155508	10.2843732	33
28	9.6639199	9.9480604	9.7158595	10.2840594	32
29	9.6641628	9.9479947	9.7161682	10.2837458	31
30	9.6644055	9.9479289	9.7164767	10.2834323	30
31	9.6646482	9.9478631	9.7167851	10.2831189	29
32	9.6648906	9.9477973	9.7170933	10.2828058	28
33	9.6651329	9.9477314	9.7174014	10.2824928	27
34	9.6653749	9.9476655	9.7177094	10.2821799	26
35	9.6656168	9.9475995	9.7180173	10.2818671	25
36	9.6658586	9.9475335	9.7183251	10.2815544	24
37	9.6661001	9.9474674	9.7186327	10.2812419	23
38	9.6663414	9.9474013	9.7189402	10.2809295	22
39	9.6665828	9.9473352	9.7192476	10.2806172	21
40	9.6668243	9.9472690	9.7195549	10.2803051	20
41	9.6670647	9.9472027	9.7198620	10.2800019	19
42	9.6673053	9.9471364	9.7201690	10.2796981	18
43	9.6675459	9.9470700	9.7204759	10.2793942	17
44	9.6677863	9.9470036	9.7207827	10.2790907	16
45	9.6680266	9.9469372	9.7210893	10.2787871	15
46	9.6682665	9.9468707	9.7213958	10.2784834	14
47	9.6685064	9.9468042	9.7217022	10.2781798	13
48	9.6687461	9.9467376	9.7220085	10.2778761	12
49	9.6689856	9.9466710	9.7223147	10.2775723	11
50	9.6692250	9.9466044	9.7226207	10.2772689	10
51	9.6694642	9.9465376	9.7229266	10.2769654	9
52	9.6697032	9.9464708	9.7232324	10.2766619	8
53	9.6699420	9.9464040	9.7235381	10.2763584	7
54	9.6701807	9.9463371	9.7238436	10.2760546	6
55	9.6704192	9.9462702	9.7241490	10.2757510	5
56	9.6706576	9.9462032	9.7244543	10.2754475	4
57	9.6708958	9.9461362	9.7247595	10.2751443	3
58	9.6711338	9.9460692	9.7250646	10.2748413	2
59	9.6713717	9.9460021	9.7253695	10.2745385	1
60	9.6716093	9.9459349	9.7256744	10.2742356	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

62 Degrees

Min.	28 Degrees			
	Sine	Sine Comp.	Tang.	Tang. Comp.
0	9.6716093	9.9459349	9.7256744	10.2743256
1	9.6718468	9.9458677	9.7259791	10.2740209
2	9.6720841	9.9458005	9.7262837	10.2737163
3	9.6723213	9.9457332	9.7265881	10.2734119
4	9.6725583	9.9456659	9.7268925	10.2731075
5	9.6727952	9.9455985	9.7271967	10.2728033
6	9.6730319	9.9455310	9.7275008	10.2724992
7	9.6732684	9.9454636	9.7278048	10.2721952
8	9.6735047	9.9453960	9.7281087	10.2718913
9	9.6737409	9.9453285	9.7284124	10.2715875
10	9.6739769	9.9452609	9.7287161	10.2712839
11	9.6742128	9.9451932	9.7290196	10.2709804
12	9.6744485	9.9451255	9.7293230	10.2706770
13	9.6746840	9.9450577	9.7296263	10.2703737
14	9.6749194	9.9449899	9.7299295	10.2700703
15	9.6751546	9.9449220	9.7302325	10.2697675
16	9.6753896	9.9448541	9.7305354	10.2694646
17	9.6756244	9.9447862	9.7308383	10.2691617
18	9.6758592	9.9447182	9.7311410	10.2688590
19	9.6760937	9.9446501	9.7314436	10.2685564
20	9.6763281	9.9445821	9.7317460	10.2682540
21	9.6765623	9.9445139	9.7320484	10.2679516
22	9.6767963	9.9444457	9.7323506	10.2676494
23	9.6770302	9.9443775	9.7326527	10.2673473
24	9.6772640	9.9443092	9.7329547	10.2670453
25	9.6774975	9.9442409	9.7332566	10.2667434
26	9.6777309	9.9441725	9.7335584	10.2664416
27	9.6779642	9.9441041	9.7338601	10.2661399
28	9.6781972	9.9440356	9.7341616	10.2658384
29	9.6784301	9.9439671	9.7344631	10.2655369
30	9.6786629	9.9438985	9.7347644	10.2652356
31	9.6788955	9.9438299	9.7350656	10.2649344
32	9.6791279	9.9437612	9.7353667	10.2646332
33	9.6793602	9.9436925	9.7356677	10.2643323
34	9.6795923	9.9436238	9.7359685	10.2640315
35	9.6798243	9.9435549	9.7362693	10.2637307
36	9.6800560	9.9434861	9.7365699	10.2634301
37	9.6802877	9.9434172	9.7368705	10.2631295
38	9.6805191	9.9433484	9.7371709	10.2628291
39	9.6807504	9.9432792	9.7374712	10.2625288
40	9.6809816	9.9432102	9.7377714	10.2622286
41	9.6812126	9.9431411	9.7380715	10.2619281
42	9.6814434	9.9430720	9.7383714	10.2616280
43	9.6816741	9.9430028	9.7386713	10.2613277
44	9.6819046	9.9429335	9.7389710	10.2610290
45	9.6821349	9.9428643	9.7392707	10.2607293
46	9.6823649	9.9427949	9.7395702	10.2604298
47	9.6825942	9.9427255	9.7398696	10.2601304
48	9.6828235	9.9426561	9.7401689	10.2598311
49	9.6830528	9.9425866	9.7404681	10.2595310
50	9.6832823	9.9425171	9.7407672	10.2592328
51	9.6835117	9.9424476	9.7410662	10.2589338
52	9.6837409	9.9423779	9.7413650	10.2586350
53	9.6839700	9.9423083	9.7416638	10.2583362
54	9.6842000	9.9422386	9.7419624	10.2580376
55	9.6844297	9.9421688	9.7422609	10.2577391
56	9.6846583	9.9420990	9.7425594	10.2574406
57	9.6848868	9.9420291	9.7428577	10.2571423
58	9.6851151	9.9419592	9.7431559	10.2568441
59	9.6853432	9.9418893	9.7434540	10.2565460
60	9.6855712	9.9418193	9.7437520	10.2562480
	Sine	Sine Comp.	Tang.	Tang. Comp.

61 Degrees

Min.	29 Degrees			
	Sine	Sine Comp.	Tang.	Tang. Comp.
0	9.6855712	9.9418193	9.7437520	10.2562480
1	9.6857991	9.9417492	9.7440499	10.2559501
2	9.6860267	9.9416791	9.7443476	10.2556524
3	9.6862542	9.9416090	9.7446453	10.2553547
4	9.6864816	9.9415388	9.7449428	10.2550572
5	9.6867088	9.9414685	9.7452403	10.2547597
6	9.6869363	9.9413982	9.7455377	10.2544624
7	9.6871628	9.9413279	9.7458349	10.2541651
8	9.6873895	9.9412575	9.7461320	10.2538680
9	9.6876161	9.9411871	9.7464290	10.2535710
10	9.6878423	9.9411166	9.7467259	10.2532741
11	9.6880688	9.9410461	9.7470227	10.2529773
12	9.6882949	9.9409755	9.7473194	10.2526806
13	9.6885209	9.9409048	9.7476161	10.2523840
14	9.6887467	9.9408342	9.7479125	10.2520875
15	9.6889723	9.9407634	9.7482089	10.2517911
16	9.6891978	9.9406927	9.7485052	10.2514948
17	9.6894232	9.9406219	9.7488013	10.2511987
18	9.6896484	9.9405510	9.7490974	10.2509026
19	9.6898734	9.9404801	9.7493934	10.2506064
20	9.6900983	9.9404091	9.7496892	10.2503108
21	9.6903231	9.9403381	9.7499850	10.2500150
22	9.6905476	9.9402670	9.7502806	10.2497194
23	9.6907721	9.9401959	9.7505762	10.2494237
24	9.6909964	9.9401248	9.7508716	10.2491284
25	9.6912205	9.9400535	9.7511669	10.2488331
26	9.6914445	9.9399823	9.7514622	10.2485378
27	9.6916683	9.9399110	9.7517573	10.2482427
28	9.6918919	9.9398398	9.7520523	10.2479477
29	9.6921155	9.9397686	9.7523472	10.2476526
30	9.6923388	9.9396968	9.7526420	10.2473580
31	9.6925622	9.9396253	9.7529368	10.2470632
32	9.6927851	9.9395537	9.7532314	10.2467686
33	9.6930080	9.9394821	9.7535259	10.2464741
34	9.6932308	9.9394105	9.7538203	10.2461797
35	9.6934534	9.9393388	9.7541146	10.2458854
36	9.6936761	9.9392671	9.7544088	10.2455912
37	9.6938981	9.9391953	9.7547029	10.2452971
38	9.6941203	9.9391234	9.7549969	10.2450031
39	9.6943422	9.9390515	9.7552908	10.2447092
40	9.6945642	9.9389796	9.7555846	10.2444152
41	9.6947859	9.9389076	9.7558783	10.2441217
42	9.6950071	9.9388356	9.7561718	10.2438281
43	9.6952288	9.9387635	9.7564653	10.2435347
44	9.6954501	9.9386914	9.7567587	10.2432413
45	9.6956712	9.9386192	9.7570520	10.2429480
46	9.6958922	9.9385470	9.7573452	10.2426548
47	9.6961130	9.9384747	9.7576383	10.2423617
48	9.6963336	9.9384024	9.7579313	10.2420687
49	9.6965541	9.9383300	9.7582243	10.2417758
50	9.6967745	9.9382576	9.7585170	10.2414830
51	9.6969947	9.9381851	9.7588096	10.2411904
52	9.6972147	9.9381126	9.7591022	10.2408978
53	9.6974347	9.9380400	9.7593947	10.2406053
54	9.6976545	9.9379674	9.7596871	10.2403129
55	9.6978741	9.9378947	9.7599794	10.2400206
56	9.6980936	9.9378220	9.7602716	10.2397284
57	9.6983129	9.9377492	9.7605637	10.2394363
58	9.6985321	9.9376764	9.7608557	10.2391443
59	9.6987511	9.9376035	9.7611476	10.2388524
60	9.6989700	9.9375306	9.7614394	10.2385606
	Sine	Sine Comp.	Tang.	Tang. Comp.

60 Degrees

Min.	30 Degrees.				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.6989700	9.9375306	9.76144394	10.2385606	60
1	9.6991837	9.9374577	9.7617321	10.2382689	59
2	9.6994073	9.9373847	9.7620227	10.2379773	58
3	9.6996258	9.9373161	9.7623140	10.2376858	57
4	9.6998441	9.9372385	9.7626056	10.2373944	56
5	9.7000622	9.9371623	9.7628969	10.2371031	55
6	9.7002802	9.9370911	9.7631881	10.2368119	54
7	9.7004981	9.9370189	9.7634792	10.2365208	53
8	9.7007158	9.9369456	9.7637702	10.2362298	52
9	9.7009334	9.9368722	9.7640612	10.2359388	51
10	9.7011508	9.9367988	9.7643520	10.2356480	50
11	9.7013681	9.9367254	9.7646427	10.2353573	49
12	9.7015852	9.9366519	9.7649334	10.2350666	48
13	9.7018022	9.9365783	9.7652239	10.2347761	47
14	9.7020190	9.9365047	9.7655143	10.2344857	46
15	9.7022357	9.9364311	9.7658047	10.2341953	45
16	9.7024523	9.9363574	9.7660949	10.2339051	44
17	9.7026687	9.9362836	9.7663851	10.2336149	43
18	9.7028849	9.9362093	9.7666751	10.2333249	42
19	9.7031011	9.9361350	9.7669651	10.2330349	41
20	9.7033170	9.9360621	9.7672550	10.2327450	40
21	9.7035329	9.9359881	9.7675448	10.2324552	39
22	9.7037486	9.9359141	9.7678344	10.2321656	38
23	9.7039641	9.9358401	9.7681240	10.2318760	37
24	9.7041795	9.9357660	9.7684135	10.2315865	36
25	9.7043947	9.9356918	9.7687029	10.2312971	35
26	9.7046099	9.9356177	9.7689922	10.2310078	34
27	9.7048248	9.9355434	9.7692816	10.2307186	33
28	9.7050397	9.9354691	9.7695708	10.2304290	32
29	9.7052543	9.9353948	9.7698596	10.2301404	31
30	9.7054689	9.9353204	9.7701485	10.2298515	30
31	9.7056833	9.9352459	9.7704373	10.2295627	29
32	9.7058975	9.9351715	9.7707261	10.2292739	28
33	9.7061116	9.9350969	9.7710147	10.2289853	27
34	9.7063256	9.9350223	9.7713033	10.2286967	26
35	9.7065394	9.9349477	9.7715917	10.2284083	25
36	9.7067531	9.9348730	9.7718801	10.2281199	24
37	9.7069667	9.9347983	9.7721684	10.2278316	23
38	9.7071801	9.9347235	9.7724566	10.2275434	22
39	9.7073933	9.9346486	9.7727447	10.2272553	21
40	9.7076064	9.9345738	9.7730327	10.2269673	20
41	9.7078194	9.9344988	9.7733206	10.2266794	19
42	9.7080323	9.9344238	9.7736084	10.2263913	18
43	9.7082450	9.9343488	9.7738961	10.2261039	17
44	9.7084575	9.9342737	9.7741838	10.2258162	16
45	9.7086699	9.9341986	9.7744713	10.2255287	15
46	9.7088822	9.9341234	9.7747588	10.2252412	14
47	9.7090943	9.9340482	9.7750462	10.2249536	13
48	9.7093063	9.9339729	9.7753334	10.2246661	12
49	9.7095182	9.9338976	9.7756206	10.2243794	11
50	9.7097299	9.9338222	9.7759077	10.2240923	10
51	9.7099415	9.9337467	9.7761947	10.2238053	9
52	9.7101529	9.9336713	9.7764816	10.2235184	8
53	9.7103642	9.9335957	9.7767686	10.2232315	7
54	9.7105753	9.9335201	9.7770552	10.2229448	6
55	9.7107863	9.9334445	9.7773418	10.2226581	5
56	9.7109972	9.9333688	9.7776284	10.2223716	4
57	9.7112080	9.9332931	9.7779149	10.2220851	3
58	9.7114186	9.9332173	9.7782012	10.2217988	2
59	9.7116290	9.9331415	9.7784875	10.2215125	1
60	9.7118393	9.9330656	9.7787737	10.2212263	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

59 Degrees.

Min.	31 Degrees.				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7118393	9.9330656	9.7787737	10.2212263	60
1	9.7120495	9.9329897	9.7790599	10.2209401	59
2	9.7122596	9.9329137	9.7793459	10.2206541	58
3	9.7124695	9.9328376	9.7796318	10.2203682	57
4	9.7126792	9.9327616	9.7799177	10.2200823	56
5	9.7128889	9.9326854	9.7802034	10.2197966	55
6	9.7130983	9.9326092	9.7804891	10.2195109	54
7	9.7133077	9.9325330	9.7807747	10.2192253	53
8	9.7135169	9.9324567	9.7810602	10.2189398	52
9	9.7137260	9.9323804	9.7813456	10.2186544	51
10	9.7139349	9.9323040	9.7816309	10.2183691	50
11	9.7141437	9.9322276	9.7819162	10.2180838	49
12	9.7143524	9.9321511	9.7822013	10.2177987	48
13	9.7145609	9.9320746	9.7824864	10.2175136	47
14	9.7147693	9.9319980	9.7827713	10.2172287	46
15	9.7149777	9.9319213	9.7830562	10.2169438	45
16	9.7151857	9.9318447	9.7833410	10.2166590	44
17	9.7153937	9.9317679	9.7836258	10.2163742	43
18	9.7156015	9.9316911	9.7839104	10.2160896	42
19	9.7158092	9.9316143	9.7841949	10.2158051	41
20	9.7160168	9.9315374	9.7844794	10.2155206	40
21	9.7162243	9.9314605	9.7847638	10.2152362	39
22	9.7164316	9.9313835	9.7850481	10.2149519	38
23	9.7166387	9.9313065	9.7853323	10.2146677	37
24	9.7168458	9.9312294	9.7856164	10.2143836	36
25	9.7170526	9.9311522	9.7859004	10.2140996	35
26	9.7172594	9.9310750	9.7861844	10.2138156	34
27	9.7174660	9.9309978	9.7864682	10.2135313	33
28	9.7176725	9.9309205	9.7867520	10.2132480	32
29	9.7178789	9.9308432	9.7870357	10.2129643	31
30	9.7180851	9.9307658	9.7873193	10.2126807	30
31	9.7182912	9.9306883	9.7876028	10.2123972	29
32	9.7184974	9.9306109	9.7878863	10.2121137	28
33	9.7187030	9.9305333	9.7881696	10.2118304	27
34	9.7189086	9.9304557	9.7884529	10.2115471	26
35	9.7191142	9.9303781	9.7887361	10.2112639	25
36	9.7193196	9.9303004	9.7890192	10.2109808	24
37	9.7195249	9.9302226	9.7893023	10.2106977	23
38	9.7197300	9.9301448	9.7895852	10.2104144	22
39	9.7199350	9.9300670	9.7898681	10.2101319	21
40	9.7201399	9.9299891	9.7901508	10.2098492	20
41	9.7203447	9.9299112	9.7904335	10.2095665	19
42	9.7205493	9.9298332	9.7907161	10.2092839	18
43	9.7207538	9.9297551	9.7909987	10.2090013	17
44	9.7209581	9.9296770	9.7912811	10.2087186	16
45	9.7211623	9.9295989	9.7915635	10.2084363	15
46	9.7213664	9.9295207	9.7918458	10.2081542	14
47	9.7215704	9.9294424	9.7921280	10.2078723	13
48	9.7217742	9.9293641	9.7924101	10.2075902	12
49	9.7219779	9.9292857	9.7926921	10.2073079	11
50	9.7221811	9.9292073	9.7929741	10.2070259	10
51	9.7223848	9.9291289	9.7932560	10.2067440	9
52	9.7225881	9.9290504	9.7935378	10.2064622	8
53	9.7227913	9.9289718	9.7938195	10.2061805	7
54	9.7229943	9.9288932	9.7941011	10.2058989	6
55	9.7231972	9.9288145	9.7943827	10.2056173	5
56	9.7234000	9.9287358	9.7946641	10.2053359	4
57	9.7236026	9.9286571	9.7949455	10.2050543	3
58	9.7238051	9.9285783	9.7952268	10.2047732	2
59	9.7240075	9.9284994	9.7955081	10.2044919	1
60	9.7242097	9.9284205	9.7957892	10.2042108	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

58 Degrees.

Min.	32 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7242097	9.9284205	9.7978789	10.2042108	60
1	9.7244118	9.9283415	9.7960703	10.2039207	59
2	9.7246138	9.9282625	9.7963113	10.2036487	58
3	9.7248157	9.9281834	9.7965622	10.2033678	57
4	9.7250174	9.9281043	9.7968132	10.2030870	56
5	9.7252189	9.9280251	9.7971938	10.2028062	55
6	9.7254204	9.9279459	9.7974745	10.2025254	54
7	9.7256217	9.9278666	9.7977551	10.2022449	53
8	9.7258229	9.9277873	9.7980356	10.2019644	52
9	9.7260240	9.9277079	9.7983162	10.2016840	51
10	9.7262249	9.9276285	9.7985964	10.2014036	50
11	9.7264257	9.9275490	9.7988767	10.2011233	49
12	9.7266264	9.9274695	9.7991569	10.2008431	48
13	9.7268269	9.9273899	9.7994370	10.2005630	47
14	9.7270273	9.9273103	9.7997170	10.2002830	46
15	9.7272276	9.9272306	9.7999970	10.2000030	45
16	9.7274278	9.9271509	9.8002769	10.1997231	44
17	9.7276278	9.9270711	9.8005567	10.1994433	43
18	9.7278277	9.9269913	9.8008365	10.1991635	42
19	9.7280275	9.9269114	9.8011161	10.1988839	41
20	9.7282271	9.9268316	9.8013957	10.1986043	40
21	9.7284267	9.9267514	9.8016752	10.1983248	39
22	9.7286260	9.9266714	9.8019546	10.1980454	38
23	9.7288253	9.9265913	9.8022340	10.1977660	37
24	9.7290244	9.9265112	9.8025133	10.1974867	36
25	9.7292234	9.9264310	9.8027925	10.1972075	35
26	9.7294223	9.9263507	9.8030716	10.1969283	34
27	9.7296211	9.9262704	9.8033506	10.1966494	33
28	9.7298197	9.9261901	9.8036296	10.1963704	32
29	9.7300182	9.9261096	9.8039085	10.1960915	31
30	9.7302165	9.9260292	9.8041873	10.1958127	30
31	9.7304148	9.9259487	9.8044661	10.1955339	29
32	9.7306129	9.9258681	9.8047447	10.1952553	28
33	9.7308109	9.9257875	9.8050233	10.1949767	27
34	9.7310087	9.9257069	9.8053019	10.1946981	26
35	9.7312064	9.9256261	9.8055805	10.1944194	25
36	9.7314040	9.9255454	9.8058587	10.1941413	24
37	9.7316015	9.9254646	9.8061370	10.1938630	23
38	9.7317989	9.9253837	9.8064152	10.1935848	22
39	9.7319961	9.9253028	9.8066933	10.1933067	21
40	9.7321932	9.9252218	9.8069714	10.1930286	20
41	9.7323902	9.9251408	9.8072494	10.1927506	19
42	9.7325876	9.9250597	9.8075273	10.1924727	18
43	9.7327847	9.9249786	9.8078052	10.1921948	17
44	9.7329816	9.9248974	9.8080830	10.1919171	16
45	9.7331786	9.9248161	9.8083606	10.1916394	15
46	9.7333751	9.9247349	9.8086383	10.1913617	14
47	9.7335719	9.9246535	9.8089158	10.1910842	13
48	9.7337684	9.9245721	9.8091933	10.1908067	12
49	9.7339644	9.9244907	9.8094707	10.1905293	11
50	9.7341602	9.9244092	9.8097480	10.1902520	10
51	9.7343559	9.9243277	9.8100253	10.1899747	9
52	9.7345515	9.9242461	9.8103025	10.1896975	8
53	9.7347470	9.9241644	9.8105796	10.1894204	7
54	9.7349423	9.9240827	9.8108566	10.1891434	6
55	9.7351375	9.9240010	9.8111336	10.1888664	5
56	9.7353326	9.9239191	9.8114105	10.1885895	4
57	9.7355276	9.9238373	9.8116873	10.1883127	3
58	9.7357225	9.9237554	9.8119641	10.1880359	2
59	9.7359174	9.9236734	9.8122408	10.1877592	1
60	9.7361122	9.9235914	9.8125174	10.1874826	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

57 Degrees

Min.	33 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7361088	9.9235914	9.8125174	10.1874826	60
1	9.7363032	9.9235093	9.8127939	10.1872061	59
2	9.7364976	9.9234272	9.8130704	10.1869296	58
3	9.7366919	9.9233450	9.8133468	10.1866532	57
4	9.7368859	9.9232628	9.8136231	10.1863769	56
5	9.7370797	9.9231805	9.8138993	10.1861007	55
6	9.7372737	9.9230982	9.8141755	10.1858245	54
7	9.7374675	9.9230158	9.8144516	10.1855484	53
8	9.7376611	9.9229334	9.8147277	10.1852723	52
9	9.7378546	9.9228509	9.8150036	10.1849964	51
10	9.7380479	9.9227684	9.8152795	10.1847205	50
11	9.7382412	9.9226858	9.8155554	10.1844446	49
12	9.7384343	9.9226032	9.8158311	10.1841689	48
13	9.7386273	9.9225205	9.8161068	10.1838932	47
14	9.7388201	9.9224377	9.8163824	10.1836176	46
15	9.7390129	9.9223549	9.8166580	10.1833420	45
16	9.7392055	9.9222721	9.8169335	10.1830664	44
17	9.7393980	9.9221891	9.8172089	10.1827911	43
18	9.7395904	9.9221062	9.8174842	10.1825158	42
19	9.7397827	9.9220232	9.8177595	10.1822405	41
20	9.7399748	9.9219401	9.8180347	10.1819653	40
21	9.7401668	9.9218570	9.8183098	10.1816902	39
22	9.7403587	9.9217738	9.8185849	10.1814151	38
23	9.7405505	9.9216906	9.8188599	10.1811401	37
24	9.7407421	9.9216073	9.8191348	10.1808652	36
25	9.7409337	9.9215240	9.8194096	10.1805904	35
26	9.7411251	9.9214406	9.8196844	10.1803156	34
27	9.7413164	9.9213572	9.8199592	10.1800408	33
28	9.7415075	9.9212737	9.8202338	10.1797662	32
29	9.7416986	9.9211902	9.8205084	10.1794916	31
30	9.7418895	9.9211066	9.8207829	10.1792171	30
31	9.7420803	9.9210229	9.8210574	10.1789426	29
32	9.7422710	9.9209393	9.8213317	10.1786683	28
33	9.7424616	9.9208555	9.8216060	10.1783940	27
34	9.7426520	9.9207717	9.8218803	10.1781196	26
35	9.7428423	9.9206878	9.8221545	10.1778455	25
36	9.7430325	9.9206039	9.8224286	10.1775714	24
37	9.7432226	9.9205200	9.8227026	10.1772973	23
38	9.7434126	9.9204360	9.8229766	10.1770234	22
39	9.7436024	9.9203519	9.8232505	10.1767495	21
40	9.7437921	9.9202678	9.8235244	10.1764756	20
41	9.7439817	9.9201836	9.8237981	10.1762019	19
42	9.7441711	9.9200994	9.8240719	10.1759281	18
43	9.7443606	9.9200151	9.8243455	10.1756545	17
44	9.7445498	9.9199308	9.8246191	10.1753806	16
45	9.7447390	9.9198464	9.8248926	10.1751074	15
46	9.7449280	9.9197619	9.8251660	10.1748340	14
47	9.7451169	9.9196775	9.8254394	10.1745606	13
48	9.7453056	9.9195932	9.8257127	10.1742873	12
49	9.7454943	9.9195083	9.8259860	10.1740141	11
50	9.7456828	9.9194237	9.8262592	10.1737408	10
51	9.7458712	9.9193390	9.8265323	10.1734677	9
52	9.7460595	9.9192542	9.8268053	10.1731947	8
53	9.7462477	9.9191694	9.8270783	10.1729217	7
54	9.7464358	9.9190845	9.8273513	10.1726487	6
55	9.7466237	9.9189996	9.8276241	10.1723759	5
56	9.7468115	9.9189146	9.8278969	10.1721034	4
57	9.7469992	9.9188296	9.8281696	10.1718304	3
58	9.7471868	9.9187445	9.8284423	10.1715577	2
59	9.7473743	9.9186594	9.8287149	10.1712851	1
60	9.7475617	9.9185742	9.8289874	10.1710126	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

56 Degrees

34 Degrees					Min.
Sine	Sine Comp.	Tang.	Tang. Comp.		
0 9.7475617	9.9181742	9.8289874	10.1710126	60	
1 9.7477489	9.9184890	9.8292599	10.1707401	59	
2 9.7479360	9.9188037	9.8295323	10.1704677	58	
3 9.7481230	9.9188183	9.8298047	10.1701953	57	
4 9.7483099	9.9188229	9.8300769	10.1699231	56	
5 9.7484967	9.9188175	9.8303492	10.1696508	55	
6 9.7486833	9.9188020	9.8306213	10.1693787	54	
7 9.7488698	9.9179764	9.8308934	10.1691066	53	
8 9.7490562	9.9178906	9.8311654	10.1688346	52	
9 9.7492425	9.9178051	9.8314373	10.1685626	51	
10 9.7494287	9.9177194	9.8317091	10.1682907	50	
11 9.7496148	9.9176336	9.8319811	10.1680189	49	
12 9.7498009	9.9175478	9.8322529	10.1677471	48	
13 9.7499866	9.9174619	9.8325248	10.1674754	47	
14 9.7501723	9.9173760	9.8327963	10.1672037	46	
15 9.7503579	9.9172902	9.8330679	10.1669321	45	
16 9.7505434	9.9172043	9.8333394	10.1666606	44	
17 9.7507287	9.9171179	9.8336109	10.1663891	43	
18 9.7509140	9.9170317	9.8338823	10.1661177	42	
19 9.7510991	9.9169455	9.8341536	10.1658464	41	
20 9.7512842	9.9168593	9.8344249	10.1655751	40	
21 9.7514691	9.9167730	9.8346961	10.1653039	39	
22 9.7516538	9.9166866	9.8349673	10.1650327	38	
23 9.7518385	9.9166002	9.8352384	10.1647610	37	
24 9.7520231	9.9165137	9.8355094	10.1644896	36	
25 9.7522075	9.9164272	9.8357804	10.1642180	35	
26 9.7523919	9.9163406	9.8360513	10.1639467	34	
27 9.7525761	9.9162539	9.8363221	10.1636753	33	
28 9.7527602	9.9161673	9.8365929	10.1634037	32	
29 9.7529442	9.9160808	9.8368636	10.1631324	31	
30 9.7531280	9.9159937	9.8371343	10.1628607	30	
31 9.7533118	9.9159069	9.8374049	10.1625891	29	
32 9.7534954	9.9158200	9.8376755	10.1623174	28	
33 9.7536790	9.9157330	9.8379460	10.1620450	27	
34 9.7538624	9.9156460	9.8382164	10.1617736	26	
35 9.7540457	9.9155589	9.8384867	10.1615023	25	
36 9.7542288	9.9154718	9.8387571	10.1612309	24	
37 9.7544119	9.9153846	9.8390273	10.1609597	23	
38 9.7545949	9.9152974	9.8392975	10.1606882	22	
39 9.7547777	9.9152101	9.8395676	10.1604164	21	
40 9.7549604	9.9151228	9.8398377	10.1601443	20	
41 9.7551431	9.9150354	9.8401077	10.1598723	19	
42 9.7553256	9.9149479	9.8403776	10.1596007	18	
43 9.7555080	9.9148604	9.8406475	10.1593295	17	
44 9.7556902	9.9147729	9.8409174	10.1590580	16	
45 9.7558724	9.9146852	9.8411871	10.1587861	15	
46 9.7560544	9.9145976	9.8414566	10.1585141	14	
47 9.7562364	9.9145100	9.8417265	10.1582423	13	
48 9.7564182	9.9144221	9.8419961	10.1579703	12	
49 9.7565999	9.9143342	9.8422657	10.1577343	11	
50 9.7567815	9.9142464	9.8425351	10.1574640	10	
51 9.7569630	9.9141584	9.8428046	10.1571934	9	
52 9.7571444	9.9140704	9.8430739	10.1569261	8	
53 9.7573256	9.9139824	9.8433432	10.1566588	7	
54 9.7575068	9.9138943	9.8436125	10.1563915	6	
55 9.7576878	9.9138061	9.8438817	10.1561243	5	
56 9.7578687	9.9137179	9.8441508	10.1558572	4	
57 9.7580495	9.9136296	9.8444199	10.1555901	3	
58 9.7582302	9.9135413	9.8446889	10.1553231	2	
59 9.7584108	9.9134530	9.8449579	10.1550561	1	
60 9.7585913	9.9133645	9.8452268	10.1547732	0	
Sine Comp.	Sine	Tang. Comp.	Tang.		Min.

55 Degrees

35 Degrees					Min.
Sine	Sine Comp.	Tang.	Tang. Comp.		
0 9.7585913	9.9133645	9.8452268	10.1547732	60	
1 9.7587717	9.9132760	9.8454956	10.1545044	59	
2 9.7589519	9.9131875	9.8457644	10.1542356	58	
3 9.7591321	9.9130989	9.8460332	10.1539668	57	
4 9.7593121	9.9130102	9.8463018	10.1536982	56	
5 9.7594920	9.9129215	9.8465705	10.1534295	55	
6 9.7596718	9.9128328	9.8468390	10.1531610	54	
7 9.7598515	9.9127440	9.8471075	10.1528925	53	
8 9.7600311	9.9126551	9.8473760	10.1526240	52	
9 9.7602107	9.9125662	9.8476444	10.1523556	51	
10 9.7603899	9.9124772	9.8479127	10.1520873	50	
11 9.7605692	9.9123882	9.8481810	10.1518190	49	
12 9.7607483	9.9122991	9.8484492	10.1515508	48	
13 9.7609273	9.9122099	9.8487174	10.1512826	47	
14 9.7611063	9.9121207	9.8489855	10.1510145	46	
15 9.7612851	9.9120315	9.8492536	10.1507464	45	
16 9.7614638	9.9119422	9.8495216	10.1504784	44	
17 9.7616424	9.9118528	9.8497896	10.1502104	43	
18 9.7618208	9.9117634	9.8500575	10.1499425	42	
19 9.7619992	9.9116739	9.8503253	10.1496747	41	
20 9.7621775	9.9115844	9.8505931	10.1494069	40	
21 9.7623555	9.9114948	9.8508608	10.1491392	39	
22 9.7625337	9.9114051	9.8511285	10.1488715	38	
23 9.7627116	9.9113155	9.8513961	10.1486039	37	
24 9.7628894	9.9112257	9.8516637	10.1483363	36	
25 9.7630671	9.9111359	9.8519312	10.1480688	35	
26 9.7632442	9.9110466	9.8521987	10.1478013	34	
27 9.7634222	9.9109561	9.8524661	10.1475339	33	
28 9.7635996	9.9108661	9.8527335	10.1472663	32	
29 9.7637769	9.9107761	9.8530008	10.1469992	31	
30 9.7639540	9.9106860	9.8532680	10.1467320	30	
31 9.7641311	9.9105959	9.8535352	10.1464648	29	
32 9.7643080	9.9105057	9.8538023	10.1461977	28	
33 9.7644849	9.9104155	9.8540694	10.1459306	27	
34 9.7646616	9.9103253	9.8543365	10.1456635	26	
35 9.7648382	9.9102348	9.8546034	10.1453965	25	
36 9.7650147	9.9101444	9.8548704	10.1451290	24	
37 9.7651911	9.9100539	9.8551372	10.1448628	23	
38 9.7653674	9.9099634	9.8554041	10.1445959	22	
39 9.7655436	9.9098728	9.8556708	10.1443292	21	
40 9.7657197	9.9097821	9.8559376	10.1440624	20	
41 9.7658957	9.9096915	9.8562042	10.1437958	19	
42 9.7660715	9.9096007	9.8564708	10.1435292	18	
43 9.7662473	9.9095099	9.8567374	10.1432625	17	
44 9.7664225	9.9094190	9.8570039	10.1429961	16	
45 9.7665985	9.9093281	9.8572704	10.1427296	15	
46 9.7667739	9.9092371	9.8575368	10.1424634	14	
47 9.7669492	9.9091461	9.8578031	10.1421969	13	
48 9.7671244	9.9090550	9.8580694	10.1419306	12	
49 9.7672996	9.9089639	9.8583357	10.1416643	11	
50 9.7674746	9.9088727	9.8586019	10.1413981	10	
51 9.7676494	9.9087814	9.8588682	10.1411320	9	
52 9.7678242	9.9086901	9.8591341	10.1408656	8	
53 9.7679988	9.9086000	9.8594002	10.1405993	7	
54 9.7681735	9.9085093	9.8596661	10.1403329	6	
55 9.7683480	9.9084159	9.8599321	10.1400679	5	
56 9.7685223	9.9083243	9.8601980	10.1398020	4	
57 9.7686960	9.9082327	9.8604638	10.1395362	3	
58 9.7688707	9.9081411	9.8607297	10.1392704	2	
59 9.7690448	9.9080494	9.8609954	10.1390046	1	
60 9.7692187	9.9079576	9.8612610	10.1387390	0	
Sine Comp.	Sine	Tang. Comp.	Tang.		Min.

54 Degrees

SINES AND TANGENTS.

183

36 Degrees				
Min.	Sine	Sine Comp.	Tang.	Tang. Comp.
0	0.7692187	0.9079576	0.8612610	10.1387300
1	0.7693251	0.9078658	0.8615267	10.1384733
2	0.7694325	0.9077740	0.8617923	10.1382177
3	0.7695398	0.9076822	0.8620579	10.1379622
4	0.7696471	0.9075904	0.8623235	10.1377067
5	0.7697544	0.9074986	0.8625891	10.1374511
6	0.7698617	0.9074068	0.8628547	10.1371956
7	0.7699690	0.9073150	0.8631203	10.1369400
8	0.7700763	0.9072232	0.8633859	10.1366845
9	0.7701836	0.9071314	0.8636515	10.1364289
10	0.7702909	0.9070396	0.8639171	10.1361734
11	0.7703982	0.9069478	0.8641827	10.1359179
12	0.7705055	0.9068560	0.8644483	10.1356624
13	0.7706128	0.9067642	0.8647139	10.1354069
14	0.7707201	0.9066724	0.8649795	10.1351514
15	0.7708274	0.9065806	0.8652451	10.1348959
16	0.7709347	0.9064888	0.8655107	10.1346404
17	0.7710420	0.9063970	0.8657763	10.1343849
18	0.7711493	0.9063052	0.8660419	10.1341294
19	0.7712566	0.9062134	0.8663075	10.1338739
20	0.7713639	0.9061216	0.8665731	10.1336184
21	0.7714712	0.9060298	0.8668387	10.1333629
22	0.7715785	0.9059380	0.8671043	10.1331074
23	0.7716858	0.9058462	0.8673699	10.1328519
24	0.7717931	0.9057544	0.8676355	10.1325964
25	0.7718904	0.9056626	0.8679011	10.1323409
26	0.7719977	0.9055708	0.8681667	10.1320854
27	0.7721050	0.9054790	0.8684323	10.1318299
28	0.7722123	0.9053872	0.8686979	10.1315744
29	0.7723196	0.9052954	0.8689635	10.1313189
30	0.7724269	0.9052036	0.8692291	10.1310634
31	0.7725342	0.9051118	0.8694947	10.1308079
32	0.7726415	0.9050200	0.8697603	10.1305524
33	0.7727488	0.9049282	0.8699959	10.1302969
34	0.7728561	0.9048364	0.8702615	10.1300414
35	0.7729634	0.9047446	0.8705271	10.1297859
36	0.7730707	0.9046528	0.8707927	10.1295304
37	0.7731780	0.9045610	0.8710583	10.1292749
38	0.7732853	0.9044692	0.8713239	10.1290194
39	0.7733926	0.9043774	0.8715895	10.1287639
40	0.7734999	0.9042856	0.8718551	10.1285084
41	0.7736072	0.9041938	0.8721207	10.1282529
42	0.7737145	0.9041020	0.8723863	10.1279974
43	0.7738218	0.9040102	0.8726519	10.1277419
44	0.7739291	0.9039184	0.8729175	10.1274864
45	0.7740364	0.9038266	0.8731831	10.1272309
46	0.7741437	0.9037348	0.8734487	10.1269754
47	0.7742510	0.9036430	0.8737143	10.1267199
48	0.7743583	0.9035512	0.8739799	10.1264644
49	0.7744656	0.9034594	0.8742455	10.1262089
50	0.7745729	0.9033676	0.8745111	10.1259534
51	0.7746802	0.9032758	0.8747767	10.1256979
52	0.7747875	0.9031840	0.8750423	10.1254424
53	0.7748948	0.9030922	0.8753079	10.1251869
54	0.7750021	0.9030004	0.8755735	10.1249314
55	0.7751094	0.9029086	0.8758391	10.1246759
56	0.7752167	0.9028168	0.8761047	10.1244204
57	0.7753240	0.9027250	0.8763703	10.1241649
58	0.7754313	0.9026332	0.8766359	10.1239094
59	0.7755386	0.9025414	0.8769015	10.1236539
60	0.7756459	0.9024496	0.8771671	10.1233984

37 Degrees				
Min.	Sine	Sine Comp.	Tang.	Tang. Comp.
0	0.7794630	0.9023486	0.8771144	10.1228856
1	0.7795693	0.9022568	0.8773799	10.1226301
2	0.7796756	0.9021650	0.8776455	10.1223746
3	0.7797819	0.9020732	0.8779111	10.1221191
4	0.7798882	0.9019814	0.8781767	10.1218636
5	0.7799945	0.9018896	0.8784423	10.1216081
6	0.7801008	0.9017978	0.8787079	10.1213526
7	0.7802071	0.9017060	0.8789735	10.1210971
8	0.7803134	0.9016142	0.8792391	10.1208416
9	0.7804197	0.9015224	0.8795047	10.1205861
10	0.7805260	0.9014306	0.8797703	10.1203306
11	0.7806323	0.9013388	0.8800359	10.1200751
12	0.7807386	0.9012470	0.8803015	10.1198196
13	0.7808449	0.9011552	0.8805671	10.1195641
14	0.7809512	0.9010634	0.8808327	10.1193086
15	0.7810575	0.9009716	0.8810983	10.1190531
16	0.7811638	0.9008798	0.8813639	10.1187976
17	0.7812701	0.9007880	0.8816295	10.1185421
18	0.7813764	0.9006962	0.8818951	10.1182866
19	0.7814827	0.9006044	0.8821607	10.1180311
20	0.7815890	0.9005126	0.8824263	10.1177756
21	0.7816953	0.9004208	0.8826919	10.1175201
22	0.7818016	0.9003290	0.8829575	10.1172646
23	0.7819079	0.9002372	0.8832231	10.1170091
24	0.7820142	0.9001454	0.8834887	10.1167536
25	0.7821205	0.9000536	0.8837543	10.1164981
26	0.7822268	0.8999618	0.8840199	10.1162426
27	0.7823331	0.8998700	0.8842855	10.1159871
28	0.7824394	0.8997782	0.8845511	10.1157316
29	0.7825457	0.8996864	0.8848167	10.1154761
30	0.7826520	0.8995946	0.8850823	10.1152206
31	0.7827583	0.8995028	0.8853479	10.1149651
32	0.7828646	0.8994110	0.8856135	10.1147096
33	0.7829709	0.8993192	0.8858791	10.1144541
34	0.7830772	0.8992274	0.8861447	10.1141986
35	0.7831835	0.8991356	0.8864103	10.1139431
36	0.7832898	0.8990438	0.8866759	10.1136876
37	0.7833961	0.8989520	0.8869415	10.1134321
38	0.7835024	0.8988602	0.8872071	10.1131766
39	0.7836087	0.8987684	0.8874727	10.1129211
40	0.7837150	0.8986766	0.8877383	10.1126656
41	0.7838213	0.8985848	0.8880039	10.1124101
42	0.7839276	0.8984930	0.8882695	10.1121546
43	0.7840339	0.8984012	0.8885351	10.1118991
44	0.7841402	0.8983094	0.8888007	10.1116436
45	0.7842465	0.8982176	0.8890663	10.1113881
46	0.7843528	0.8981258	0.8893319	10.1111326
47	0.7844591	0.8980340	0.8895975	10.1108771
48	0.7845654	0.8979422	0.8898631	10.1106216
49	0.7846717	0.8978504	0.8901287	10.1103661
50	0.7847780	0.8977586	0.8903943	10.1101106
51	0.7848843	0.8976668	0.8906599	10.1098551
52	0.7849906	0.8975750	0.8909255	10.1095996
53	0.7850969	0.8974832	0.8911911	10.1093441
54	0.7852032	0.8973914	0.8914567	10.1090886
55	0.7853095	0.8972996	0.8917223	10.1088331
56	0.7854158	0.8972078	0.8919879	10.1085776
57	0.7855221	0.8971160	0.8922535	10.1083221
58	0.7856284	0.8970242	0.8925191	10.1080666
59	0.7857347	0.8969324	0.8927847	10.1078111
60	0.7858410	0.8968406	0.8930503	10.1075556

53 Degrees

52 Degrees

Min.	38 Degrees.				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7893420	9.8965321	9.8928093	10.1071907	60
1	9.7895030	9.8964334	9.8930702	10.1069298	59
2	9.7896642	9.8963346	9.8933306	10.1066694	58
3	9.7898266	9.8962358	9.8935909	10.1064091	57
4	9.7899888	9.8961369	9.8938511	10.1061489	56
5	9.7901493	9.8960379	9.8941114	10.1058886	55
6	9.7903104	9.8959389	9.8943715	10.1056285	54
7	9.7904715	9.8958398	9.8946317	10.1053683	53
8	9.7906325	9.8957406	9.8948918	10.1051082	52
9	9.7907933	9.8956414	9.8951519	10.1048481	51
10	9.7909541	9.8955422	9.8954119	10.1045881	50
11	9.7911148	9.8954429	9.8956719	10.1043281	49
12	9.7912754	9.8953435	9.8959319	10.1040681	48
13	9.7914359	9.8952440	9.8961918	10.1038082	47
14	9.7915963	9.8951445	9.8964517	10.1035483	46
15	9.7917566	9.8950450	9.8967116	10.1032884	45
16	9.7919168	9.8949453	9.8969714	10.1030286	44
17	9.7920769	9.8948457	9.8972312	10.1027688	43
18	9.7922369	9.8947459	9.8974910	10.1025090	42
19	9.7923968	9.8946461	9.8977507	10.1022493	41
20	9.7925566	9.8945463	9.8980104	10.1019896	40
21	9.7927163	9.8944463	9.8982700	10.1017300	39
22	9.7928760	9.8943464	9.8985296	10.1014704	38
23	9.7930355	9.8942463	9.8987892	10.1012108	37
24	9.7931949	9.8941462	9.8990487	10.1009513	36
25	9.7933543	9.8940461	9.8993082	10.1006918	35
26	9.7935135	9.8939468	9.8995677	10.1004323	34
27	9.7936727	9.8938476	9.8998271	10.1001729	33
28	9.7938317	9.8937482	9.9000865	10.0999135	32
29	9.7939907	9.8936488	9.9003459	10.0996541	31
30	9.7941496	9.8935494	9.9006052	10.0993948	30
31	9.7943083	9.8934499	9.9008645	10.0991355	29
32	9.7944670	9.8933503	9.9011237	10.0988763	28
33	9.7946256	9.8932506	9.9013830	10.0986170	27
34	9.7947841	9.8931509	9.9016422	10.0983578	26
35	9.7949425	9.8930512	9.9019013	10.0980987	25
36	9.7951008	9.8929514	9.9021604	10.0978396	24
37	9.7952590	9.8928515	9.9024195	10.0975805	23
38	9.7954171	9.8927515	9.9026786	10.0973214	22
39	9.7955751	9.8926515	9.9029376	10.0970624	21
40	9.7957330	9.8925515	9.9031966	10.0968034	20
41	9.7958909	9.8924514	9.9034555	10.0965443	19
42	9.7960486	9.8923512	9.9037144	10.0962852	18
43	9.7962062	9.8922510	9.9039733	10.0960262	17
44	9.7963638	9.8921508	9.9042321	10.0957670	16
45	9.7965212	9.8920506	9.9044910	10.0955079	15
46	9.7966786	9.8919503	9.9047497	10.0952487	14
47	9.7968359	9.8918500	9.9050085	10.0949895	13
48	9.7969930	9.8917496	9.9052672	10.0947302	12
49	9.7971501	9.8916492	9.9055259	10.0944709	11
50	9.7973071	9.8915488	9.9057845	10.0942115	10
51	9.7974640	9.8914483	9.9060431	10.0939523	9
52	9.7976208	9.8913478	9.9063017	10.0936930	8
53	9.7977775	9.8912472	9.9065603	10.0934337	7
54	9.7979341	9.8911466	9.9068188	10.0931744	6
55	9.7980906	9.8910460	9.9070773	10.0929151	5
56	9.7982470	9.8909453	9.9073357	10.0926558	4
57	9.7984034	9.8908446	9.9075941	10.0923965	3
58	9.7985596	9.8907438	9.9078525	10.0921372	2
59	9.7987158	9.8906430	9.9081109	10.0918779	1
60	9.7988718	9.8905422	9.9083692	10.0916186	0
Sine Comp.	Sine	Tang. Comp.	Tang.	Min.	

51 Degrees

Min.	39 Degrees.				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7988718	9.8905026	9.9086362	10.0916308	60
1	9.7990278	9.8904023	9.9088945	10.0913715	59
2	9.7991836	9.8903019	9.9091528	10.0911122	58
3	9.7993394	9.8902015	9.9094111	10.0908529	57
4	9.7994951	9.8901012	9.9096694	10.0905936	56
5	9.7996507	9.8899999	9.9099277	10.0903343	55
6	9.7998064	9.8898987	9.9101860	10.0900750	54
7	9.7999616	9.8897975	9.9104443	10.0898157	53
8	9.8001169	9.8896962	9.9107026	10.0895564	52
9	9.8002721	9.8895949	9.9109609	10.0892971	51
10	9.8004272	9.8894936	9.9112192	10.0890378	50
11	9.8005823	9.8893923	9.9114775	10.0887785	49
12	9.8007372	9.8892910	9.9117358	10.0885192	48
13	9.8008921	9.8891897	9.9119941	10.0882599	47
14	9.8010468	9.8890884	9.9122524	10.0879999	46
15	9.8012015	9.8889871	9.9125107	10.0877400	45
16	9.8013561	9.8888858	9.9127690	10.0874801	44
17	9.8015106	9.8887845	9.9130273	10.0872202	43
18	9.8016649	9.8886832	9.9132856	10.0869603	42
19	9.8018192	9.8885819	9.9135439	10.0867004	41
20	9.8019735	9.8884806	9.9138022	10.0864405	40
21	9.8021276	9.8883793	9.9140605	10.0861806	39
22	9.8022816	9.8882780	9.9143188	10.0859207	38
23	9.8024355	9.8881767	9.9145771	10.0856608	37
24	9.8025894	9.8880754	9.9148354	10.0854009	36
25	9.8027431	9.8879741	9.9150937	10.0851410	35
26	9.8028968	9.8878728	9.9153520	10.0848811	34
27	9.8030504	9.8877715	9.9156103	10.0846212	33
28	9.8032038	9.8876702	9.9158686	10.0843613	32
29	9.8033572	9.8875689	9.9161269	10.0841014	31
30	9.8035105	9.8874676	9.9163852	10.0838415	30
31	9.8036637	9.8873663	9.9166435	10.0835816	29
32	9.8038169	9.8872650	9.9169018	10.0833217	28
33	9.8039699	9.8871637	9.9171601	10.0830618	27
34	9.8041228	9.8870624	9.9174184	10.0828019	26
35	9.8042757	9.8869611	9.9176767	10.0825420	25
36	9.8044284	9.8868598	9.9179350	10.0822821	24
37	9.8045811	9.8867585	9.9181933	10.0820222	23
38	9.8047336	9.8866572	9.9184516	10.0817623	22
39	9.8048861	9.8865559	9.9187099	10.0815024	21
40	9.8050385	9.8864546	9.9189682	10.0812425	20
41	9.8051908	9.8863533	9.9192265	10.0809826	19
42	9.8053432	9.8862520	9.9194848	10.0807227	18
43	9.8054955	9.8861507	9.9197431	10.0804628	17
44	9.8056478	9.8860494	9.9199999	10.0802029	16
45	9.8057999	9.8859481	9.9202582	10.0799430	15
46	9.8059521	9.8858468	9.9205165	10.0796831	14
47	9.8061042	9.8857455	9.9207748	10.0794232	13
48	9.8062564	9.8856442	9.9210331	10.0791633	12
49	9.8064086	9.8855429	9.9212914	10.0789034	11
50	9.8065607	9.8854416	9.9215497	10.0786435	10
51	9.8067128	9.8853403	9.9218080	10.0783836	9
52	9.8068649	9.8852390	9.9220663	10.0781237	8
53	9.8070170	9.8851377	9.9223246	10.0778638	7
54	9.8071691	9.8850364	9.9225829	10.0776039	6
55	9.8073212	9.8849351	9.9228412	10.0773440	5
56	9.8074733	9.8848338	9.9230995	10.0770841	4
57	9.8076254	9.8847325	9.9233578	10.0768242	3
58	9.8077775	9.8846312	9.9236161	10.0765643	2
59	9.8079296	9.8845299	9.9238744	10.0763044	1
60	9.8080817	9.8844286	9.9241327	10.0760445	0
Sine Comp.	Sine	Tang. Comp.	Tang.	Min.	

50 Degrees

Min.	40 Degrees			
	Sine	Sine Comp.	Tang.	Tang. Comp.
0	9.8080675	9.8842540	9.9238135	10.0761805
1	9.8082180	9.8841479	9.9240701	10.0759299
2	9.8083684	9.8840418	9.9243266	10.0756734
3	9.8085188	9.8839357	9.9245831	10.0754169
4	9.8086690	9.8838296	9.9248396	10.0751604
5	9.8088192	9.8837232	9.9250960	10.0749040
6	9.8089692	9.8836168	9.9253525	10.0746476
7	9.8091192	9.8835104	9.9256088	10.0743912
8	9.8092691	9.8834039	9.9258652	10.0741348
9	9.8094189	9.8832974	9.9261217	10.0738785
10	9.8095686	9.8831908	9.9263778	10.0736222
11	9.8097182	9.8830841	9.9266341	10.0733659
12	9.8098678	9.8829774	9.9268904	10.0731096
13	9.8100174	9.8828706	9.9271466	10.0728534
14	9.8101669	9.8827638	9.9274027	10.0725972
15	9.8103165	9.8826568	9.9276589	10.0723410
16	9.8104660	9.8825499	9.9279152	10.0720848
17	9.8106154	9.8824429	9.9281713	10.0718287
18	9.8107651	9.8823357	9.9284274	10.0715726
19	9.8109147	9.8822285	9.9286835	10.0713165
20	9.8110643	9.8821213	9.9289396	10.0710604
21	9.8112139	9.8820140	9.9291956	10.0708044
22	9.8113634	9.8819067	9.9294516	10.0705483
23	9.8115129	9.8817992	9.9297076	10.0702924
24	9.8116625	9.8816918	9.9299636	10.0700364
25	9.8118120	9.8815842	9.9302195	10.0697805
26	9.8119615	9.8814766	9.9304755	10.0695245
27	9.8121110	9.8813689	9.9307314	10.0692686
28	9.8122605	9.8812612	9.9309873	10.0690127
29	9.8124100	9.8811534	9.9312432	10.0687569
30	9.8125595	9.8810455	9.9314990	10.0685011
31	9.8126923	9.8809376	9.9317547	10.0682453
32	9.8128401	9.8808296	9.9320105	10.0679895
33	9.8129878	9.8807215	9.9322662	10.0677338
34	9.8131354	9.8806134	9.9325220	10.0674780
35	9.8132829	9.8805052	9.9327777	10.0672223
36	9.8134303	9.8803970	9.9330334	10.0669665
37	9.8135777	9.8802889	9.9332890	10.0667107
38	9.8137250	9.8801803	9.9335446	10.0664549
39	9.8138721	9.8800719	9.9338002	10.0661992
40	9.8140192	9.8799634	9.9340559	10.0659434
41	9.8141662	9.8798548	9.9343114	10.0656876
42	9.8143131	9.8797462	9.9345670	10.0654318
43	9.8144600	9.8796375	9.9348226	10.0651759
44	9.8146067	9.8795287	9.9350782	10.0649200
45	9.8147534	9.8794199	9.9353337	10.0646642
46	9.8148999	9.8793110	9.9355889	10.0644084
47	9.8150464	9.8792021	9.9358444	10.0641526
48	9.8151928	9.8790930	9.9360998	10.0638968
49	9.8153391	9.8789840	9.9363552	10.0636410
50	9.8154854	9.8788748	9.9366105	10.0633852
51	9.8156315	9.8787656	9.9368659	10.0631294
52	9.8157776	9.8786563	9.9371212	10.0628736
53	9.8159235	9.8785470	9.9373766	10.0626178
54	9.8160694	9.8784378	9.9376318	10.0623620
55	9.8162152	9.8783281	9.9378871	10.0621062
56	9.8163609	9.8782186	9.9381423	10.0618504
57	9.8165066	9.8781090	9.9383975	10.0615946
58	9.8166521	9.8779994	9.9386527	10.0613388
59	9.8167975	9.8778896	9.9389079	10.0610830
60	9.8169429	9.8777799	9.9391631	10.0608272
	Sine Comp.	Sine	Tang. Comp.	Tang.

Min.	41 Degrees			
	Sine	Sine Comp.	Tang.	Tang. Comp.
0	9.8169429	9.8777799	9.9391631	10.0608272
1	9.8170882	9.8776700	9.9394182	10.0605714
2	9.8172334	9.8775601	9.9396733	10.0603156
3	9.8173787	9.8774501	9.9399284	10.0600598
4	9.8175235	9.8773401	9.9401835	10.0598040
5	9.8176688	9.8772300	9.9404388	10.0595482
6	9.8178133	9.8771198	9.9406939	10.0592924
7	9.8179583	9.8770096	9.9409486	10.0590366
8	9.8181028	9.8768993	9.9412036	10.0587808
9	9.8182474	9.8767889	9.9414585	10.0585250
10	9.8183919	9.8766785	9.9417133	10.0582692
11	9.8185364	9.8765680	9.9419684	10.0580134
12	9.8186809	9.8764574	9.9422233	10.0577576
13	9.8188252	9.8763468	9.9424782	10.0575018
14	9.8189696	9.8762361	9.9427331	10.0572460
15	9.8191133	9.8761255	9.9429879	10.0569902
16	9.8192573	9.8760149	9.9432428	10.0567344
17	9.8194012	9.8759043	9.9434976	10.0564786
18	9.8195450	9.8757937	9.9437524	10.0562228
19	9.8196888	9.8756831	9.9440072	10.0559670
20	9.8198325	9.8755726	9.9442619	10.0557112
21	9.8199761	9.8754620	9.9445166	10.0554554
22	9.8201196	9.8753514	9.9447714	10.0551996
23	9.8202630	9.8752408	9.9450261	10.0549438
24	9.8204063	9.8751302	9.9452808	10.0546880
25	9.8205496	9.8750196	9.9455355	10.0544322
26	9.8206929	9.8749090	9.9457902	10.0541764
27	9.8208363	9.8747984	9.9460447	10.0539206
28	9.8209796	9.8746878	9.9462993	10.0536648
29	9.8211227	9.8745772	9.9465538	10.0534090
30	9.8212658	9.8744666	9.9468083	10.0531532
31	9.8214087	9.8743560	9.9470628	10.0528974
32	9.8215516	9.8742454	9.9473173	10.0526416
33	9.8216942	9.8741348	9.9475717	10.0523858
34	9.8218368	9.8740242	9.9478262	10.0521300
35	9.8219793	9.8739136	9.9480806	10.0518742
36	9.8221218	9.8738030	9.9483351	10.0516184
37	9.8222642	9.8736924	9.9485895	10.0513626
38	9.8224067	9.8735818	9.9488439	10.0511068
39	9.8225490	9.8734712	9.9490983	10.0508510
40	9.8226913	9.8733606	9.9493527	10.0505952
41	9.8228336	9.8732500	9.9496071	10.0503394
42	9.8229759	9.8731394	9.9498615	10.0500836
43	9.8231182	9.8730288	9.9501159	10.0498278
44	9.8232605	9.8729182	9.9503703	10.0495720
45	9.8234027	9.8728076	9.9506247	10.0493162
46	9.8235449	9.8726970	9.9508791	10.0490604
47	9.8236872	9.8725864	9.9511334	10.0488046
48	9.8238294	9.8724758	9.9513878	10.0485488
49	9.8239717	9.8723652	9.9516421	10.0482930
50	9.8241139	9.8722546	9.9518965	10.0480372
51	9.8242561	9.8721440	9.9521508	10.0477814
52	9.8243983	9.8720334	9.9524052	10.0475256
53	9.8245405	9.8719228	9.9526595	10.0472698
54	9.8246827	9.8718122	9.9529139	10.0470140
55	9.8248249	9.8717016	9.9531682	10.0467582
56	9.8249671	9.8715910	9.9534225	10.0465024
57	9.8251093	9.8714804	9.9536768	10.0462466
58	9.8252515	9.8713698	9.9539311	10.0459908
59	9.8253937	9.8712592	9.9541854	10.0457350
60	9.8255359	9.8711486	9.9544397	10.0454792
	Sine Comp.	Sine	Tang. Comp.	Tang.

Min.	42 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.8255109	9.8710735	9.9544374	10.0455626	60
1	9.8256512	9.8709597	9.9546915	10.0453085	59
2	9.8257913	9.8708458	9.9549455	10.0450545	58
3	9.8259314	9.8707319	9.9551995	10.0448005	57
4	9.8260715	9.8706179	9.9554535	10.0445465	56
5	9.8262114	9.8705039	9.9557075	10.0442925	55
6	9.8263512	9.8703898	9.9559615	10.0440385	54
7	9.8264910	9.8702756	9.9562154	10.0437845	53
8	9.8266307	9.8701613	9.9564694	10.0435305	52
9	9.8267703	9.8700470	9.9567234	10.0432765	51
10	9.8269098	9.8699326	9.9569772	10.0430225	50
11	9.8270493	9.8698183	9.9572311	10.0427685	49
12	9.8271887	9.8697037	9.9574850	10.0425145	48
13	9.8273279	9.8695891	9.9577389	10.0422605	47
14	9.8274671	9.8694744	9.9579927	10.0420065	46
15	9.8276063	9.8693597	9.9582465	10.0417525	45
16	9.8277453	9.8692449	9.9585004	10.0414985	44
17	9.8278843	9.8691301	9.9587542	10.0412445	43
18	9.8280231	9.8690152	9.9590080	10.0409905	42
19	9.8281619	9.8689002	9.9592618	10.0407365	41
20	9.8283006	9.8687851	9.9595155	10.0404825	40
21	9.8284393	9.8686700	9.9597693	10.0402285	39
22	9.8285778	9.8685548	9.9600230	10.0399745	38
23	9.8287163	9.8684396	9.9602767	10.0397205	37
24	9.8288547	9.8683242	9.9605305	10.0394665	36
25	9.8289930	9.8682088	9.9607842	10.0392125	35
26	9.8291312	9.8680934	9.9610378	10.0389585	34
27	9.8292694	9.8679779	9.9612915	10.0387045	33
28	9.8294075	9.8678623	9.9615452	10.0384505	32
29	9.8295454	9.8677466	9.9617988	10.0382011	31
30	9.8296833	9.8676309	9.9620525	10.0379471	30
31	9.8298212	9.8675151	9.9623061	10.0376930	29
32	9.8299589	9.8673992	9.9625597	10.0374393	28
33	9.8300966	9.8672833	9.9628133	10.0371857	27
34	9.8302342	9.8671673	9.9630669	10.0369321	26
35	9.8303717	9.8670512	9.9633204	10.0366785	25
36	9.8305091	9.8669351	9.9635740	10.0364246	24
37	9.8306464	9.8668189	9.9638275	10.0361705	23
38	9.8307837	9.8667026	9.9640811	10.0359168	22
39	9.8309209	9.8665863	9.9643346	10.0356624	21
40	9.8310580	9.8664699	9.9645881	10.0354081	20
41	9.8311950	9.8663534	9.9648416	10.0351538	19
42	9.8313320	9.8662369	9.9650951	10.0348994	18
43	9.8314688	9.8661203	9.9653486	10.0346451	17
44	9.8316056	9.8660036	9.9656020	10.0343908	16
45	9.8317422	9.8658868	9.9658555	10.0341364	15
46	9.8318789	9.8657700	9.9661089	10.0338811	14
47	9.8320155	9.8656531	9.9663623	10.0336267	13
48	9.8321519	9.8655362	9.9666157	10.0333723	12
49	9.8322883	9.8654192	9.9668692	10.0331180	11
50	9.8324246	9.8653021	9.9671225	10.0328637	10
51	9.8325609	9.8651849	9.9673759	10.0326094	9
52	9.8326970	9.8650677	9.9676293	10.0323550	8
53	9.8328331	9.8649504	9.9678827	10.0321007	7
54	9.8329691	9.8648331	9.9681360	10.0318464	6
55	9.8331050	9.8647156	9.9683893	10.0315921	5
56	9.8332408	9.8645981	9.9686427	10.0313377	4
57	9.8333766	9.8644806	9.9688960	10.0310834	3
58	9.8335122	9.8643629	9.9691493	10.0308291	2
59	9.8336478	9.8642452	9.9694026	10.0305747	1
60	9.8337833	9.8641275	9.9696559	10.0303204	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

47 Degrees

Min.	43 Degrees				Min.
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.8337833	9.8641275	9.9696559	10.0303204	60
1	9.8339188	9.8640096	9.9699091	10.0300659	59
2	9.8340541	9.8638917	9.9701624	10.0298115	58
3	9.8341894	9.8637737	9.9704157	10.0295573	57
4	9.8343246	9.8636557	9.9706689	10.0293031	56
5	9.8344597	9.8635376	9.9709221	10.0290489	55
6	9.8345948	9.8634194	9.9711754	10.0287946	54
7	9.8347297	9.8633011	9.9714286	10.0285404	53
8	9.8348646	9.8631828	9.9716818	10.0282862	52
9	9.8349994	9.8630644	9.9719350	10.0280320	51
10	9.8351341	9.8629460	9.9721882	10.0277778	50
11	9.8352688	9.8628277	9.9724413	10.0275235	49
12	9.8354033	9.8627093	9.9726945	10.0272693	48
13	9.8355378	9.8625909	9.9729477	10.0270150	47
14	9.8356722	9.8624724	9.9732008	10.0267607	46
15	9.8358066	9.8623540	9.9734539	10.0265064	45
16	9.8359408	9.8622358	9.9737071	10.0262520	44
17	9.8360750	9.8621174	9.9739602	10.0260000	43
18	9.8362091	9.8619989	9.9742133	10.0257478	42
19	9.8363431	9.8618807	9.9744664	10.0254955	41
20	9.8364771	9.8617624	9.9747195	10.0252432	40
21	9.8366110	9.8616443	9.9749726	10.0250000	39
22	9.8367447	9.8615260	9.9752257	10.0247478	38
23	9.8368784	9.8614077	9.9754787	10.0244955	37
24	9.8370121	9.8612893	9.9757318	10.0242432	36
25	9.8371456	9.8611708	9.9759849	10.0240000	35
26	9.8372791	9.8610524	9.9762379	10.0237478	34
27	9.8374125	9.8609341	9.9764909	10.0235000	33
28	9.8375458	9.8608158	9.9767439	10.0232522	32
29	9.8376790	9.8606974	9.9769969	10.0230000	31
30	9.8378122	9.8605790	9.9772500	10.0227500	30
31	9.8379453	9.8604606	9.9775030	10.0225000	29
32	9.8380783	9.8603423	9.9777561	10.0222478	28
33	9.8382114	9.8602240	9.9780091	10.0220000	27
34	9.8383441	9.8601056	9.9782620	10.0217522	26
35	9.8384769	9.8600000	9.9785149	10.0215000	25
36	9.8386096	9.8598816	9.9787679	10.0212521	24
37	9.8387422	9.8597631	9.9790209	10.0210000	23
38	9.8388747	9.8596446	9.9792738	10.0207522	22
39	9.8390070	9.8595260	9.9795268	10.0205000	21
40	9.8391396	9.8594075	9.9797797	10.0202522	20
41	9.8392719	9.8592890	9.9800326	10.0200000	19
42	9.8394040	9.8591705	9.9802855	10.0197522	18
43	9.8395363	9.8590520	9.9805385	10.0195000	17
44	9.8396686	9.8589335	9.9807914	10.0192522	16
45	9.8398008	9.8588150	9.9810443	10.0190000	15
46	9.8399329	9.8586965	9.9812972	10.0187522	14
47	9.8400649	9.8585780	9.9815501	10.0185000	13
48	9.8401969	9.8584595	9.9818030	10.0182522	12
49	9.8403289	9.8583410	9.9820559	10.0180000	11
50	9.8404609	9.8582225	9.9823088	10.0177522	10
51	9.8405929	9.8581040	9.9825617	10.0175000	9
52	9.8407249	9.8579855	9.9828146	10.0172522	8
53	9.8408569	9.8578670	9.9830675	10.0170000	7
54	9.8409889	9.8577485	9.9833204	10.0167522	6
55	9.8411209	9.8576300	9.9835733	10.0165000	5
56	9.8412529	9.8575115	9.9838262	10.0162522	4
57	9.8413849	9.8573930	9.9840791	10.0160000	3
58	9.8415169	9.8572745	9.9843320	10.0157522	2
59	9.8416489	9.8571560	9.9845849	10.0155000	1
60	9.8417809	9.8570375	9.9848378	10.0152522	0
	Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

46 Degrees

Min.	44 Degrees			
	Sine	Sine Comp.	Tang.	Tang. Comp.
0	9.8417713	9.8569349	9.9848372	10.0151628 60
1	9.8419021	9.8568121	9.9850900	10.0149100 59
2	9.8420328	9.8566900	9.9853428	10.0146572 58
3	9.8421634	9.8565678	9.9855956	10.0144044 57
4	9.8422939	9.8564455	9.9858484	10.0141516 56
5	9.8424244	9.8563232	9.9861012	10.0138988 55
6	9.8425548	9.8562008	9.9863540	10.0136460 54
7	9.8426851	9.8560784	9.9866068	10.0133932 53
8	9.8428154	9.8559558	9.9868596	10.0131404 52
9	9.8429456	9.8558332	9.9871123	10.0128877 51
10	9.8430757	9.8557106	9.9873651	10.0126349 50
11	9.8432058	9.8555878	9.9876179	10.0123821 49
12	9.8433356	9.8554650	9.9878706	10.0121294 48
13	9.8434655	9.8553421	9.9881234	10.0118766 47
14	9.8435953	9.8552192	9.9883761	10.0116239 46
15	9.8437250	9.8550961	9.9886289	10.0113711 45
16	9.8438547	9.8549730	9.9888816	10.0111184 44
17	9.8439842	9.8548499	9.9891344	10.0108656 43
18	9.8441137	9.8547266	9.9893871	10.0106129 42
19	9.8442432	9.8546033	9.9896399	10.0103601 41
20	9.8443725	9.8544799	9.9898926	10.0101074 40
21	9.8445018	9.8543564	9.9901453	10.0098547 39
22	9.8446310	9.8542329	9.9903981	10.0096019 38
23	9.8447601	9.8541093	9.9906508	10.0093492 37
24	9.8448891	9.8539856	9.9909035	10.0090965 36
25	9.8450181	9.8538619	9.9911562	10.0088438 35
26	9.8451470	9.8537381	9.9914089	10.0085911 34
27	9.8452758	9.8536142	9.9916616	10.0083384 33
28	9.8454045	9.8534905	9.9919143	10.0080857 32
29	9.8455332	9.8533662	9.9921670	10.0078330 31
30	9.8456618	9.8532421	9.9924197	10.0075803 30
Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

Min.	44 Degrees			
	Sine	Sine Comp.	Tang.	Tang. Comp.
30	9.8456618	9.8532421	9.9924197	10.0075803 30
31	9.8457903	9.8531179	9.9926724	10.0073276 29
32	9.8459188	9.8529936	9.9929251	10.0070749 28
33	9.8460471	9.8528693	9.9931778	10.0068222 27
34	9.8461754	9.8527449	9.9934305	10.0065695 26
35	9.8463036	9.8526204	9.9936832	10.0063168 25
36	9.8464318	9.8524959	9.9939359	10.0060641 24
37	9.8465599	9.8523713	9.9941886	10.0058114 23
38	9.8466879	9.8522466	9.9944413	10.0055587 22
39	9.8468158	9.8521218	9.9946940	10.0053060 21
40	9.8469436	9.8519970	9.9949466	10.0050533 20
41	9.8470714	9.8518721	9.9951993	10.0048007 19
42	9.8471991	9.8517471	9.9954520	10.0045480 18
43	9.8473267	9.8516220	9.9957047	10.0042953 17
44	9.8474543	9.8514969	9.9959573	10.0040426 16
45	9.8475817	9.8513717	9.9962100	10.0037899 15
46	9.8477091	9.8512465	9.9964627	10.0035373 14
47	9.8478365	9.8511211	9.9967154	10.0032846 13
48	9.8479637	9.8509957	9.9969680	10.0030320 12
49	9.8480909	9.8508702	9.9972207	10.0027793 11
50	9.8482180	9.8507446	9.9974734	10.0025266 10
51	9.8483450	9.8506190	9.9977260	10.0022740 9
52	9.8484720	9.8504933	9.9979787	10.0020213 8
53	9.8485989	9.8503675	9.9982314	10.0017686 7
54	9.8487257	9.8502417	9.9984840	10.0015159 6
55	9.8488524	9.8501157	9.9987367	10.0012633 5
56	9.8489791	9.8500907	9.9989893	10.0010107 4
57	9.8491057	9.8500657	9.9992420	10.0007580 3
58	9.8492322	9.8500407	9.9994947	10.0005053 2
59	9.8493586	9.8500153	9.9997473	10.0002527 1
60	9.8494850	9.8500000	10.0000000	10.0000000 0
Sine Comp.	Sine	Tang. Comp.	Tang.	Min.

LOG

LOG

LOGARITHMIC CURVE. If on the line AN both ways ind- finitely extended, be taken AC, CE, EG, GI, IL, on the right hand; and also A, G, P, &c. on the left, all equal to one another: and if at the points P, G, A, C, E, G, I, L, be erected to the right line AN, the perpendiculars PS, G, A, B, C, D, E, F, G, H, I, K, L, M, which let be continually proportional, and represent numbers, viz. AB, 1; CD, 10; EF, 100, &c. then shall we have two progressions of lines, arithmetical and geometrical: for the lines AC, AE, AG, &c. are in arithmetical progression, or as 1, 2, 3, 4, 5, &c. and so represent the logarithms to which the geometrical lines AB, CD, EF, &c. do correspond. For since AG is triple of the first line AC, the number GH shall be in the third place from unity, if CD be in the first: so likewise shall LM be in the fifth place, since AL = 5 AC. If the extremities of the proportionals S, d, B, D, F, &c. be joined by right lines, the figures SBML will become a polygon, consisting of more or less sides, according as there are more or less terms in the progression.

If the parts A, C, E, G, &c. be bisected in the points c, e, g, i, k, l, there be again raised the perpendiculars, cd, ef, gh, ik, lm, which are mean proportionals between AB, CD, EF, &c. then there will arise a new series of proportionals, whose terms, beginning from that which immediately follows

unity, are double of those in the first series, and the Logarithmic curve, difference of the terms is become less, and approach nearer to a ratio of equality than before. Likewise, in this new series, the right lines AL, Ae, express the distances of the terms LM, cd, from unity, viz. since AL is ten times greater than Ae, LM shall be the tenth term of the series from unity: and because Ae is three times greater than Ac, ef will be the third term of the series if cd be the first, and there shall be two mean proportionals between AB and ef, and between AB and LM there will be nine mean proportionals. And if the extremities of the lines B, d, F, f, B, &c. be joined by right lines, there will be a new polygon made, consisting of more but shorter sides than the last.

If, in this manner, mean proportionals be continually placed between every two terms, the number of terms at last will be made so great, as also the number of the sides of the polygon, as to be greater than any given number, or to be infinite; and every side of the polygon so lessened, as to become less than any given right line; and consequently the polygon will be changed into a curve-lined figure; for any curve-lined figure may be conceived as a polygon, whose sides are infinitely small and infinite in number. A curve described after this manner is called logarithmical.

It is manifest from this description of the logarithmic curve, that all numbers at equal distances are continually

Logarithmic Lines.

tinually proportional. It is also plain, that if there be four numbers, AB, CD, IK, LM, such that the distance between the first and second be equal to the distance between the third and the fourth, let the distance from the second to the third be what it will, these numbers will be proportional. For because the distances AC, IL, are equal, AB shall be to the increment D, as IK is to the increment MT. Wherefore, by composition, AB : DC :: IK : ML. And, contrariwise, if four numbers be proportional, the distance between the first and second shall be equal to the distance between the third and fourth.

The distance between any two numbers is called the *logarithm of the ratio of those numbers*; and, indeed, doth not measure the ratio itself, but the number of terms in a given series of geometrical proportionals, proceeding from one number to another, and defines the number of equal ratios by the composition whereof the ratios of number is known.

LOGARITHMIC Lines. For many mechanical purposes it is convenient to have the logarithms of numbers laid down on scales, as well as the logarithmic lines and tangents; by which means, computations may be carried on by mere mensuration with compasses. Lines of this kind are always put on the common Gunter's scale; but as these instruments must be extended to a very great length, in order to contain any considerable quantity of numbers, it becomes an object of importance to shorten them. Such an improvement has been made by Mr William Nicholson, and published in the 77th volume of the Philosophical Transactions. The principles on which the construction of his instruments depends are as follow:

1. If two geometrical series of numbers, having the same common ratio, be placed in order with the terms opposite to each other, the ratio between any term in one series and its opposite in the other will be constant: Thus,

2 6 18 54 162, &c.

3 9 27 81 243, &c. Then,

2 3 6 9 18 27 54 81 162 243, &c.

where it is evident, that each of the terms in the upper series is exactly two-thirds of the corresponding one in the lower.

2. The ratio of any two terms in one series will be the same with that between those which have an equal distance in the other.

3. In all such geometrical series as have the same ratio, the property above-mentioned takes place, tho' we compare the terms of any series with those of another: Thus,

2 4 8 16 32 64, &c.

3 6 12 24 48 96, &c.

4 8 16 32 64 128, &c.

5 10 20 40 80 160, &c.; where it is

plain that 2, 4, 3, 6; also 2, 4, 4, 8, and 2, 4, 5, 10, &c. have the same ratio with that of each series.

4. If the differences of the logarithms of the numbers be laid in order upon equidistant parallel right lines, in such a manner that a right line drawn across the whole shall intersect it at divisions denoting numbers in geometrical progression; then, from the condition of the arrangement, and the property of this logarithmic line, it follows, 1st, That every right line so drawn will, by its intersections, indicate a geometrical series of numbers; 2^{dly}, That such series as are indi-

cated by these right lines will have the same common ratio; and, 3^{dly}, That the series thus indicated by two parallel right lines, supposed to move laterally, without changing either their mutual distance or parallelism to themselves, will have each the same ratio, and in all series indicated by such two lines, the ratio between an antecedent and consequent; the former taken upon one line, and the latter upon another, will be also the same.

The 1st of these propositions is proved in the following manner. Let the lines AB, CD, EF, represent parts of the logarithmic line arranged according to the proportion already mentioned; and let GH be a right line passing through the points *e, c, a*, denoting numbers in geometrical progression; then will any other line IK, drawn across the arrangement, likewise pass through three points *f, d, b*, in geometrical progression. From one of the points of intersection *f* in the last mentioned line IK, draw the line *fg* parallel to GH, and intersecting the arrangement in the points *i, b*; and the ratios of the numbers *e, f, c, i*, will be equal, as well as of *a, b*; because the intervals on the logarithmic line, or differences of the logarithms of those numbers, are equal. Again, the point *f*, the line *id*, and the line *hb*, are in arithmetical progression denoting the differences between the logarithms of the numbers themselves; whence the quotients of the numbers are in geometrical progression.

The 2^d proposition is proved in a similar manner. For as it was shown that the line *fg*, parallel to GH, passes through points of division denoting numbers in the same continued ratio as those indicated by the line GH; it may also be shown, that the line LM parallel to any other line IK, will pass through a series of points denoting numbers which have the same continued ratio with those indicated by the line IK, to which it is parallel.

The 3^d proposition arises from the parallelism of the lines to their former situation; by which means they indicate numbers in a geometrical series, having the same common ratio as before: their distance on the logarithmic line also remains unchanged; whence the differences between the logarithms of the opposite numbers, and of consequence their ratios, will always be constant.

5. Supposing now an antecedent and consequent to be given in any geometrical series, it will always be possible to find them, provided the line be of unlimited length. Drawing two parallel lines, then, through each of the numbers, and supposing the lines to move without changing their direction or parallel situation, they will continually describe new antecedents and consequents in the same geometrical series as before.

6. Though the logarithmic line contain no greater range of numbers than from 1 to 10, it will not be found necessary for the purposes of computation to repeat it. The only thing requisite is to have a slider or beam with two fixed points at the distance of the interval betwixt 1 and 10, and a moveable point be made to range betwixt them always to indicate the antecedent; then, if the consequent fixed point fall without the rule, the other fixed point will always denote the division on which it would have fallen had the rule been prolonged; and this contrivance may easily be adapted to any arrangement of parallel lines whatever. The arrangement of right lines, however, ought always to be disposed in such a manner as to occupy a right

Logarithmic Lines.

Plate CCLXXXIII fig. 11.

Logarithmic Lines.

right angled parallelogram, or the cross line already mentioned ought always to be at right angles to the length of the ruler.

Fig. 7. is a ruler consisting of ten parallel lines. Fig. 8. a beam-compass for measuring the intervals. B, A, C, are the parts which apply to the surface of the ruler; the middle one, A, being moveable sidewise in a groove in the piece DE, so as always to preserve its parallelism to the external pieces DC, which are fixed at a distance equal to the length of the ruler, and have their edges placed in such a manner as to form with the parallel lines which they intersect a ratio, which by composition is $\frac{1}{2}$; which in the present case requires them to be at right angles to the length. The piece DE is applied to the edge FG of the ruler. The edges or borders H, I, K, L, are more conveniently made of transparent horn, or tortoise-shell, than of any opaque matter.

In using this ruler, apply the edge of either B or C to the consequent, and slide the piece A to the antecedent; observing the difference between the numbers on the pieces denoting the lines they are found on; then, applying the same edge of A to any other antecedent, the other piece B or C will intersect a consequent in the same ratio upon that line, having the same situation with regard to the antecedent that the line of the former consequent had to its antecedent. But if B be the consequent piece, and fall without the ruler, the piece C will show the consequent one line lower; or if C, in like manner, fall without the ruler, then B will show the consequent one line higher. "It might be convenient (says Mr. Nicholson) for the purpose of computation, to make instruments of this kind with one hundred or more lines: but in the present instrument, the numbers on the pieces will answer the same purpose; for if a consequent fall upon a line at any given number of intervals without the ruler, it will be found on that line of the arrangement which occupies the same number of intervals reckoned inwards from the opposite edge of the ruler."

Fig. 9. is an instrument on the plan of a Gunter's scale of 28 $\frac{1}{2}$ inches long, invented by the late Mr. Robertson. There is a moveable piece AB in the slider GH, across which is drawn a fine line: the slider having also lines CD, EF, drawn across it at distances from each other equal to the length of the ruler AB. In using the instrument, the line CD or EF is to be placed at the consequent, and the line in AB at the antecedent: then, if the piece AB be placed at any other antecedent, the same line CD or EF will indicate its consequent in the same ratio taken the same way: that is, if the antecedent and consequent lie on the

Logarithmic Lines.

same side of the slider, all other antecedents and consequents in that ratio will be in the same manner; and the contrary if they do not. But if the consequent line fall without the rule, the other fixed line on the slider will show the consequent, but on the contrary side of the slider to that where it would else have been seen by means of the first consequent line.

Fig. 10. is a circular instrument equivalent to the former; consisting of three concentric circles engraved and graduated upon a plate of an inch and an half diameter. Two legs A and B proceed from the centre, having right-lined edges in the direction of radii; and are moveable either singly or together. In using the instrument, place one of the edges at the antecedent and the other at the consequent, and fix them at the angle. Move the two legs then together; and having placed the antecedent leg at any other number, the other will give the consequent one in the like position on the lines. If the line CD happen to lie between the legs, and B be the consequent leg, the number sought will be found one line farther from the centre than it would otherwise have been; and on the contrary, it will be found one line nearer in the like case, if A be the consequent leg. "This instrument (says Mr. Nicholson) differing from that represented fig. 7. only in its circular form, and the advantages resulting from that form, the lines must be taken to succeed each other in the same manner laterally; so that numbers which fall either within or without the arrangement of circles, will be found on such lines of the arrangement as would have occupied the vacant places if the succession of lines had been indefinitely repeated sidewise.

"I approve of this construction as superior to every other which has yet occurred to me, not only in point of convenience, but likewise in the probability of being better executed; because small arcs may be graduated with very great accuracy, by divisions transferred from a larger original. The instrument, fig. 7. may be contained conveniently in a circle of about four inches and an half diameter.

"The circular instrument is a combination of the Gunter's line and the sector, with the improvements here pointed out. The property of the sector may be useful in magnifying the differences of the logarithms in the upper parts of the line of sines, the middle of the tangents, and the beginning of the versed sines. It is even possible, as mathematicians will easily conceive, to draw spirals, on which graduations of parts, every where equal to each other, will show the ratios of those lines by moveable radii, similar to those in this instrument."

L O G I C.

LOGIC is the art of thinking and reasoning justly; or, it may be defined the science or history of the human mind, inasmuch as it traces the progress of our knowledge from our first and most simple conceptions through all their different combinations, and all those numerous deductions that result from variously comparing them one with another.

The precise business of logic therefore is, To explain

the nature of the human mind, and the proper manner of conducting its several powers, in order to the attainment of truth and knowledge. It lays open those errors and mistakes we are apt, through inattention, to run into; and teaches us how to distinguish between truth, and what only carries the appearance of it. By these means we grow acquainted with the nature and force of the understanding; see what things lie within its reach.

reach; where we may attain certainty and demonstration; and when we must be contented with probability.

This science is generally divided into four parts,

viz. *Perception, Judgement, Reasoning, and Method.* This division comprehends the whole history of the sensations and operations of the human mind.

PART I. OF PERCEPTION.

WE find ourselves surrounded with a variety of objects, which acting differently upon our senses, convey distinct impressions into the mind, and thereby rouse the attention and notice of the understanding. By reflecting too on what passes within us, we become sensible of the operations of our own minds, and attend to them as a new set of impressions. But in all this there is only bare *consciousness*. The mind, without proceeding any farther, takes notice of the impressions that are made upon it, and views things in order, as they present themselves one after another. This attention of the understanding to the object acting upon it, whereby it becomes sensible of the impressions they make, is called by logicians *perception*; and the notices themselves, as they exist in the mind, and are there treasured up to be the materials of thinking and knowledge, are distinguished by the name of *ideas*. In the article *METAPHYSICS* it shall be shown at large, how the mind, being furnished with ideas, contrives to diversify and enlarge its stock: we have here chiefly to consider the means of making known our thoughts to others; that we may not only understand how knowledge is acquired, but also in what manner it may be communicated with the greatest certainty and advantage.

CHAP. I. Of Words, considered as the Signs of our Ideas.

Words furnish the means of recording our own thoughts;

I. OUR ideas, though manifold and various, are nevertheless all within our own breasts, invisible to others, nor can of themselves be made appear. But God, designing us for society, and to have fellowship with those of our kind, has provided us with organs fitted to frame articulate sounds, and given us also a capacity of using those sounds as signs of internal conceptions. Hence spring words and language: for, having once pitched upon any sound to stand as the mark of an idea in the mind, custom by degrees establishes such a connection between them, that the appearance of the idea in the understanding always brings to our remembrance the sound or name by which it is expressed; as in like manner the hearing of the sound never fails to excite the idea for which it is made to stand. And thus it is easy to conceive how a man may record his own thoughts, and bring them again into view in any succeeding period of life. For this connection being once settled, as the same sounds will always serve to excite the same ideas; if he can but contrive to register his words in the order and disposition in which the present train of his thoughts present themselves to his imagination, it is evident he will be able to recal these thoughts at pleasure, and that too in the very manner of their first appearance. Accordingly we find, that the inventions of writing and printing, by enabling us to fix and perpetuate such

perishable things as sounds, have also furnished us with the means of giving a kind of permanency to the transactions of the mind, inasmuch that they may be in the same manner subjected to our review as any other objects of nature.

II. But, besides the ability of recording our own thoughts, there is this farther advantage in the use of external signs, that they enable us to communicate our thoughts to others, and also to receive information of what passes in their breasts. For any number of men, having agreed to establish the same sounds as signs of the same ideas, it is apparent that the repetition of these sounds must excite the like perceptions in each, and create a perfect correspondence of thoughts. When, for instance, any train of ideas succeeds one another in my mind, if the names by which I am wont to express them have been annexed by those with whom I converse to the very same set of ideas, nothing is more evident, than that, by repeating those names according to the tenor of my present conceptions, I shall raise in their minds the same course of thought as has taken possession of my own. For by barely attending to what passes within themselves upon hearing the sounds which I repeat, they will also become acquainted with the ideas in my understanding, and have them in a manner laid before their view. So that we here clearly perceive how a man may communicate his sentiments, knowledge, and discoveries to others, if the language in which he converses be extensive enough to mark all the ideas and transactions of his mind. But as this is not always the case, and men are often obliged to invent terms of their own to express new views and conceptions of things; it may be asked, how in these circumstances we can become acquainted with the thoughts of another, when he makes use of words, to which we have never annexed any ideas, and that of course can raise no perceptions in our minds? In order to unveil this mystery, and give some little insight into the foundation, growth, and improvement of language, the following observations will be found of considerable moment.

III. First, that no word can be to any man the sign of an idea, till that idea comes to have a real existence in his mind. For names, being only so far intelligible as they denote known internal conceptions; where they have none such to answer them, there by they are plainly sounds without signification, and of course convey no instruction or knowledge. But no sooner are the ideas to which they belong raised in the understanding, than, finding it easy to connect them with the established names, we can join in any agreement of this kind made by others, and thereby enjoy the benefit of their discoveries. The first thing therefore to be considered is, how these ideas may be conveyed into the mind; that being there, we may learn to connect

And of the mutual communication of knowledge from one man to another.

Simple ideas cannot be conveyed into the mind by words, or a description.

ness them with their appropriated sounds, and so become capable of understanding others when they make use of these sounds in laying open and communicating their thoughts. Now, to comprehend this distinctly, it will be necessary to attend to the division of our ideas into simple and complex, (see *METAPHYSICS*.) And first, as for our simple ideas; they can find no admission into the mind, but by the two original fountains of knowledge, sensation and reflection. If therefore any of these have as yet no being in the understanding, it is impossible by words or a description to excite them there. A man who had never felt the sensation of *heat*, could not be brought to comprehend that sensation by any thing we might say to explain it. If we would really produce the idea in him, it must be by applying the proper object to his senses, and bringing him within the influence of a hot body. When this is done, and experience has taught him the perception to which men have annexed the name *heat*, it then becomes to him the sign of that idea, and he thenceforth understands the meaning of the term, which, before, all the words in this world would not have been sufficient to convey into his mind. The case is the same in respect of light and colours. A man born blind, and thereby deprived of the only conveyance for the ideas of this class, can never be brought to understand the names by which they are expressed. The reason is plain: they stand for ideas that have no existence in his mind; and as the organ appropriated to their reception is wanting, all other contrivances are vain, nor can they by any force or description be raised in his imagination. But it is quite otherwise in our complex notions. For these being no more than certain combinations of simple ideas, put together in various forms; if the original ideas out of which the collections are made have already got admission into the understanding, and the names serving to express them are known; it will be easy, by enumerating the several ideas concerned in the composition, and marking the order and manner in which they are united, to raise any complex conception in the mind. Thus the idea answering to the word *rain-bow* may be readily excited in the imagination of another who has never seen the appearance itself, by barely describing the figure, largeness, position, and order of colours; if we suppose these several simple ideas, with their names, sufficiently known to him.

IV. And this leads to a second observation upon this subject, namely, That words standing for complex ideas are all definable, but those by which we denote simple ideas are not; for simple ideas being secondary perceptions, which have no other entrance into the mind than by sensation or reflection, can only be got by experience, from the several objects of nature, proper to produce those perceptions in us. Words indeed may very well serve to remind us of them, if they have already found admission into the understanding, and their connection with the established names is known; but they can never give them their original being and existence there. And hence it is, that when any one asks the meaning of a word denoting a simple idea, we pretend not to explain it to him by a definition, well knowing that to be impossible; but, supposing him already acquainted with the idea, and only ignorant of the name by which it is called, we either men-

tion it to him by some other name with which we presume he knows its connection, or appeal to the object where the idea itself is found. Thus, were any one to ask the meaning of the word *white*, we should tell him it stood for the same idea as *albus* in Latin, or *blanc* in French; or, if we thought him a stranger to these languages, we might appeal to an object producing the idea, by saying it denoted the colour we observe in *snow* or *milk*. But this is by no means a definition of the word, exciting a new idea in his understanding; but merely a contrivance to remind him of a known idea, and teach him its connection with the established name. For if the ideas after which he inquires have never yet been raised in his mind; as suppose one who had seen no other colours than *black* and *white*, should ask the meaning of the word *scarlet*; it is easy to perceive, that it would be no more possible to make him comprehend it by words, or a definition, than to introduce the same perception into the imagination of a man born blind. The only method in this case is, to present some object, by looking at which the perception itself may be excited; and thus he will learn both the name and the idea together.

V. But how comes it to pass that men agree in the names of their simple ideas, seeing they cannot view the perceptions in one another's minds, nor make known these perceptions by words to others? The effect is produced by experience and observation. Thus finding, for instance, that the name of *heat* is annexed to that sensation which men feel when they approach the fire, I make it also the sign of the sensation excited in me by such an approach, nor have any doubt but it denotes the same perception in my mind as in theirs. For we are naturally led to imagine, that the same objects operate alike upon the organs of the human body, and produce an uniformity of sensations. No man fancies, that the idea raised in him by the taste of *sugar*, and which he calls *sweetness*, differs from that excited in another by the like means; or that *wormwood*, to whose relish he has given the epithet *bitter*, produces in another the sensation which he denotes by the word *sweet*. Presuming therefore upon this conformity of perceptions, when they arise from the same objects, we easily agree as to the names of our simple ideas: and if at any time, by a more narrow scrutiny into things, new ideas of this class come in our way, which we choose to express by terms of our own invention; these names are explained, not by a definition, but by referring to the objects whence the ideas themselves may be obtained.

VI. Being in this manner furnished with simple ideas, and the names by which they are expressed; the meaning of terms that stand for complex ideas is easily got, because the ideas themselves answering to these terms may be conveyed into the mind by definitions. For our complex notions are only certain combinations of simple ideas. When therefore these are enumerated, and the manner in which they are united into one conception explained, nothing more is wanting to raise that conception in the understanding; and thus the term denoting it comes of course to be understood. And here it is worth while to reflect a little upon the wise contrivance of nature, in thus furnishing us with the very aptest means of communicating our thoughts. For were it not so ordered, that

5
Experience and observation bring men to an agreement in the names of simple ideas.

6
The conveyance of complex ideas by definitions, a wise contrivance in nature;

4
The names of complex ideas definable, those of simple ideas not.

that we could thus convey our complex ideas from one to another by definitions, it would in many cases be impossible to make them known at all. This is apparent in those ideas which are the proper work of the mind. For as they exist only in the understanding, and have no real objects in nature in conformity to which they are framed; if we could not make them known by description, they must lie for ever hid within our own breasts, and be confined to the narrow acquaintance of a single mind. All the fine scenes that arise from time to time in the poet's fancy, and by his lively painting give such entertainment to his readers; were he destitute of this faculty of laying them open to the view of others by words and description, could not extend their influence beyond his own imagination, or give joy to any but the original inventor.

7
And of great avail towards the improvement of knowledge

VII. There is this farther advantage in the ability we enjoy of communicating our complex notions by definitions; that as these make by far the largest class of our ideas, and most frequently occur in the progress and improvement of knowledge, so they are by these means imparted with the greatest readiness, than which nothing would tend more to the increase and spreading of science: for a definition is soon perused; and if the terms of it are well understood, the idea itself finds an easy admission into the mind. Whereas in simple perceptions, where we are referred to the objects producing them, if these cannot be come at, as is sometimes the case, the names by which they are expressed must remain empty sounds. But new ideas of this class occurring very rarely in the sciences, they seldom create any great obstruction. It is otherwise with our complex notions; for every step we take leading us into new combinations and views of things, it becomes necessary to explain these to others, before they can be made acquainted with our discoveries: and as the manner of definitions is easy, requiring no apparatus but that of words, which are always ready, and at hand; hence we can with the less difficulty remove such obstacles as might arise from terms of our own invention, when they are made to stand for new complex ideas suggested to the mind by some present train of thinking. And thus at last we are let into the mystery hinted at in the beginning of this chapter, viz. how we may become acquainted with the thoughts of another, when he makes use of words to which we have as yet joined no ideas. The answer is obvious from what has been already said. If the terms denote simple perceptions, he must refer us to these objects of nature whence the perceptions themselves are to be obtained; but, if they stand for complex ideas, their meaning may be explained by a definition.

CHAP. II. Of Definitions.

8
Definition defined.

I. A Definition is the unfolding of some conception of the mind, answering to the word or term made use of as the sign of it. Now as, in exhibiting any idea to another, it is necessary that the description be such as may excite that precise idea in his mind; hence it is plain that definitions, properly speaking, are not arbitrary, but confined to the representing of certain determinate settled notions, such namely as are annexed by the speaker or writer to the words he uses. As never-

N° 185.

theless it is universally allowed that the signification of words is perfectly voluntary, and not the effect of any natural and necessary connection between them and the ideas for which they stand; some may perhaps wonder why definitions are not so too. In order therefore to unravel this difficulty, and show distinctly what is and what is not arbitrary in speech, we must carefully distinguish between the connection of our words and ideas, and the unfolding of the ideas themselves.

II. First, as to the connection of our words and ideas; this, it is plain, is a purely arbitrary institution. When, for instance, we have in our minds the idea of any particular species of metals, the calling it by the name *gold* is an effect of the voluntary choice of men speaking the same language, and not of any peculiar aptness in that sound to express that idea. Other nations we find make use of different sounds, and with the same effect. Thus *aurum* denotes that idea in Latin, and *or* in French; and even the word *gold* itself would have as well served to express the idea of that metal which we call *silver*, had custom in the beginning established it.

9
The connection between words and ideas, a perfectly voluntary establishment.

III. But although we are thus entirely at liberty in connecting any idea with any sound, yet it is quite otherwise in unfolding the ideas themselves. For every idea having a precise appearance of its own, by which it is distinguished from every other idea; it is so manifested, that in laying it open to others, we must represent it as it really is. Any such description as shall exhibit that peculiar appearance. When we have formed to ourselves the idea of a figure bounded by four equal sides, joined together at right angles, we are at liberty to express that idea by any sound, and call it either a *square* or a *triangle*. But whichever of these names we use, so long as the idea is the same, the description by which we would signify it to another must be so too. Let it be called *square* or *triangle*, it is still a figure having four equal sides, and all its angles right ones. Hence we clearly see what is and what is not arbitrary in the use of words. The establishing any sound as the mark of some determinate idea in the mind, is the effect of free choice, and a voluntary combination among men: and as different nations make use of different sounds to denote the same ideas, hence proceeds all that variety of languages which we meet with in the world. But when a connection between our ideas and words is once settled, the unfolding of the ideas answering to any word, which properly constitutes a definition, is by no means an arbitrary thing: for here we are bound to exhibit that precise conception which either the use of language, or our own particular choice, hath annexed to the term we use.

IV. And thus it appears, that definitions, considered as descriptions of ideas in the mind, are steady and invariable, being bounded to the representation of these precise ideas. But then, in the application of definitions to particular names, we are altogether left to our own free choice. Because as the connecting of any idea with any sound is a perfectly arbitrary institution, the applying the description of that idea to that sound must be so too. When therefore logicians tell us that the definition of the name is arbitrary, they mean no more than this; that as different ideas may

10
The description of ideas not so, but bounded by that which it is manifested, that in laying it open to others, we must represent it as it really is. Any such description as shall exhibit that peculiar appearance by which they are distinguished among themselves.

11
Causes of the obscurity by that has hitherto perplexed the theory of definitions.

be connected with any term, according to the good pleasure of him that uses it; in like manner may different descriptions be applied to the term suitable, to the ideas so connected. But this connection being settled, and the term considered as the sign of some fixed idea in the understanding, we are no longer left to arbitrary explications, but must study such a description as corresponds with that precise idea. Now this alone, according to what has been before laid down, ought to be accounted a definition. What seems to have occasioned no small confusion in this matter, is, that many explanations of words, where no idea is unfolded, but merely the connection between some word and idea asserted, have yet been dignified with the name of definitions. Thus, when we say that *a clock is an instrument by which we measure time*; that is by some called a definition; and yet it is plain that we are beforehand supposed to have an idea of this instrument, and only taught that the word *clock* serves in common language to denote that idea.

By this rule all explications of words in our dictionaries will be definitions, nay, the names of even simple ideas may be thus defined. *White*, we may say, is the colour we observe in snow or milk; *heat* the sensation produced by approaching the fire; and so in innumerable other instances. But these, and all others of the like kind, are by no means definitions, exciting new ideas in the understanding, but merely contrivances to remind us of known ideas, and teach their connection with the established names.

Complex ideas alone capable of definition which goes by the name of a definition.

V. But now in definitions properly so called, we first consider the term we use, as the sign of some inward conception, either annexed to it by custom, or our own free choice; and then the business of the definition is to unfold and explicate that idea. As therefore the whole art lies in giving just and true copies of our ideas; a definition is then said to be made perfect, when it serves distinctly to excite the idea described in the mind of another, even supposing him before wholly unacquainted with it. This point settled, let us next inquire what those ideas are which are capable of being thus unfolded? And in the first place it is evident, that all our simple ideas are necessarily excluded. We have seen already that experience alone is to be consulted here, inasmuch that if either the objects whence they are derived come not in our way, or the avenues appointed by nature for their reception, are wanting, no description is sufficient to convey them into the mind. But where the understanding is already supplied with these original and primitive conceptions, as they may be united together in an infinity of different forms; so may all their several combinations be distinctly laid open, by enumerating the simple ideas concerned in the various collections, and tracing the order and manner in which they are linked one to another. Now these combinations of simple notions constitute what we call our complex notions; whence it is evident, that complex ideas, and those alone, admit of that kind of description which goes by the name of a definition.

VI. Definitions, then, are pictures or representations of our ideas; and as these representations are then only possible when the ideas themselves are complex, it is obvious to remark, that definitions cannot have place but where we make use of terms

VOL. X. Part I.

standing for such complex ideas. But our complex ideas, being, as we have said, nothing more than different combinations of simple ideas; we then know and comprehend them perfectly, when we know the several simple ideas of which they consist, and can so put them together in our minds as may be necessary towards the framing of that peculiar connection which gives every idea its distinct and proper appearance.

VII. Two things are therefore required in every definition: first, That all the original ideas, out of which the complex one is formed, be distinctly enumerated; and, secondly, That the order and manner of combining them into one conception be clearly explained. Where a definition has these requisites, nothing is wanting to its perfection; because every one who reads it and understands the terms, seeing at once what ideas he is to join together, and also in what manner, can at pleasure form in his own mind the complex conception answering to the term defined. Let us, for instance, suppose the word *square* to stand for that idea by which we represent to ourselves a figure whose sides subtend quadrants of a circumscribed circle. The parts of this idea are the sides bounding the figure. These must be four in number, and all equal among themselves, because they are each to subtend a fourth part of the same circle. But, besides these component parts, we must also take notice of the manner of putting them together, if we would exhibit the precise idea for which the word *square* here stands. For four equal right lines, any-how joined, will not subtend quadrants of a circumscribed circle. A figure with this property must have its sides standing also at right angles. Taking in therefore this last consideration respecting the manner of combining the parts, the idea is fully described, and the definition thereby rendered complete. For a figure bounded by four equal sides, joined together at right angles, has the property required; and is moreover the only right-lined figure to which that property belongs.

VIII. It will now be obvious to every one, in what manner we ought to proceed, in order to arrive at just and adequate definitions. First, we are to take a just and exact view of the idea to be described, trace it to its original principles, and mark the several simple perceptions that enter into the composition of it. Secondly, we are to consider the particular manner in which these elementary ideas are combined, in order to the forming of that precise conception for which the term we make use of stands. When this is done, and the idea wholly unravelled, we have nothing more to do than fairly transcribe the appearance it makes to our own minds. Such a description, by distinctly exhibiting the order and number of our primitive conceptions, cannot fail to excite at the same time in the mind of every one that reads it, the complex idea resulting from them; and therefore attains the true and proper end of a definition.

CHAP. III. Of the Composition and Resolutions of our Ideas, and the Rules of Definition thence arising.

I. THE rule laid down in the foregoing chapter is general, extending to all possible cases; and is indeed that to which alone we can have recourse, where any

B b doubt

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In com-
pounding
our ideas,
we proceed
by a suc-
cessive gra-
dation.

doubt or difficulty arises. It is not, however, necessary that we should practise it in every particular instance. Many of our ideas are extremely complicated, inso-much that to enumerate all the simple perceptions out of which they are formed, would be a very trouble-some and tedious work. For this reason logicians have established certain compendious rules of defining, of which it may not be amiss here to give some ac-count. But in order to the better understanding of what follows, it will be necessary to observe, that there is a certain gradation in the composition of our ideas. The mind of man is very limited in its views, and cannot take in a great number of objects at once. We are therefore fain to proceed by steps, and make our first advances subservient to those which follow. Thus, in forming our complex notions, we begin at first with but a few simple ideas, such as we can manage with ease, and unite them together into one conception. When we are provided with a sufficient stock of these, and have by habit and use rendered them familiar to our minds, they become the com-ponent parts of other ideas still more complicated, and form what we may call a second order of compound notions. This process, as is evident, may be continued to any degree of composition we please, mount-ing from one stage to another, and enlarging the number of combinations.

16
Hence ideas
of this class
best com-
prehended,
when we
advance
gradually
through all
the several
orders.

II. But now in a series of this kind, whoever would acquaint himself perfectly with the last and highest order of ideas, finds it much the most expedient method to proceed gradually through all the inter-mediate steps. For, were he to take any very compound idea to pieces, and, without regard to the several classes of simple perceptions that have already been formed into distinct combinations, break it at once into its original principles, the number would be so great as perfectly to confound the imagination, and overcome the utmost reach and capacity of the mind. When we see a prodigious multitude of men jumbled together in crowds, without order or any regular position, we find it impossible to arrive at an exact knowledge of their number. But if they are formed into separate bat-talions, and so stationed as to fall within the leisure survey of the eye; by viewing them successively and in order, we come to an easy and certain deter-mination. It is the same in our complex ideas. When the original perceptions, out of which they are framed, are very numerous, it is not enough that we take a view of them in loose and scattered bodies; we must form them into distinct classes, and unite these classes in a just and orderly manner, before we can arrive at a true knowledge of the compound notions resulting from them.

17
Our defini-
tions should
keep pace
with our
ideas, and
observe a
like grada-
tion.

III. This gradual progress of the mind to its com-pound notions, through a variety of intermediate steps, plainly points out the manner of conducting the definitions by which these notions are conveyed into the minds of others. For as the series begins with simple and easy combinations, and advances through a suc-cession of different orders, rising one above another in the degree of composition, it is evident, that, in a train of definitions expressing these ideas, a like gradation is to be observed. Thus the complex ideas of the lowest order can no otherwise be described than by enumerating the simple ideas out of which they are made, and explaining the manner of their union. But

then in the second, or any other succeeding order, as they are formed out of those gradual combinations, and constitute the inferior classes, it is not necessary, in describing them, to mention one by one all the sim-ple ideas of which they consist. They may be more distinctly and briefly unfolded, by enumerating the compound ideas of a lower order, from whose union they result, and which are all supposed to be already known in consequence of previous definitions. Here then it is that the logical method of defining takes place; which, that it may be the better understood, we shall explain somewhat more particularly the fe-veral steps and gradations of the mind in compounding its ideas, and thence deduce that peculiar form of a definition which logicians have thought fit to estab-lish.

IV. All the ideas we receive from the several ob-jects of nature that surround us, represent distinct in-dividuals. These individuals, when compared toge-ther, are found in certain particulars to resemble each other. Hence, by collecting the resembling particulars into one conception, we form the notion of a *species*. And here let it be observed, that this last idea is less complicated than that by which we represent any of the particular objects contained under it. For the idea of the species excludes the peculiarities of the several individuals, and retains only such properties as are common to them all. Again, by comparing several species together, and observing their resemblance, we form the idea of a *genus*; where, in the same manner as before, the composition is lessened, because we leave out what is peculiar to the several species com-pared, and retain only the particulars wherein they agree. It is easy to conceive the mind proceeding thus from one step to another, and advancing through its several classes of general notions, until at last it comes to the highest genus of all, denoted by the word *being*, where the bare idea of existence is only con-cerned.

V. In this procedure we see the mind unravelling a complex idea, and tracing it in the ascending scale, from greater or less degrees of composition, until it terminates in one simple perception. If now we take the series the contrary way, and, beginning with the last or highest genus, carry our view downwards, through all the inferior genera and species, quite to the individuals, we shall thereby arrive at a distinct apprehension of the conduct of the understanding in compounding its ideas. For, in the several classes of our perceptions, the highest in the scale is for the most part made up of but a few simple ideas, such as the mind can take in and survey with ease. This first general notion, when branched out into the different subdivisions contained under it, has in every one of them something peculiar, by which they are distin-guished among themselves; inso-much that, in de-scending from the genus to the species, we always superadd some new idea, and thereby increase the degree of composition. Thus the idea denoted by the word *figure* is of a very general nature, and com-posed of but few simple perceptions, as implying no more than space every where bounded. But if we descend farther, and consider the boundaries of this space, as that they may be either lines or surface, we fall into the several species of figure. For where the space is bounded by one or more surfaces, we give it the

18
The steps
by which
the mind
proceeds
from parti-
cular to ge-
neral ideas.

19
The con-
duct of the
mind in
com-und-
ing its i-
deas, as it
advances
thru' the
different
orders of
perception.

name of a *solid figure*; but where the boundaries are lines, it is called a *plain figure* (A).

20
The idea of
the species
found by
superad-
ding the
specific dif-
ference to
the genus.

VI. In this view of things it is evident, that the species is formed by superadding a new idea to the genus. Here, for instance, the genus is circumscribed space. If now to this we superadd the idea of a circumscription by lines, we frame the notion of that species of figures which are called *plain*; but if we conceive the circumscription to be by surfaces, we have the species of solid figures. This superadded idea is called the *specific difference*, not only as it serves

to divide the species from the genus, but because, being different in all the several subdivisions, we thereby also distinguish the species one from another. And as it is likewise that conception, which, by being joined to the general idea, completes the notion of the species; hence it is plain, that the genus and specific difference are to be considered as the proper and constituent parts of the species. If we trace the progress of the mind still farther, and observe it advancing through the inferior species, we shall find its manner of proceeding to be always the same. For every lower

B b 2
species

(A) This account of the composition and resolution of our ideas is agreeable to the common doctrine of logicians on the subject. Into the truth of the doctrine itself we shall inquire afterwards under the article *METAPHYSICS*; but to prevent mistakes, it may be proper to observe here, that though every writer of logic has treated largely of *general* and *specific ideas*, there is in reality nothing *general* in the matter but the *terms of language*. When we utter, for instance, the word *triangle*, that *general term* does not, as has been often said, suggest to the mind the *general idea* of a triangle, which is neither *oblique nor rectangle*, neither *equilateral nor scalenon*, &c. for such a triangle, as it cannot exist in nature, cannot be conceived in idea. In like manner, the *general term* *Virtue* does not excite a general idea of *virtue*, which is neither *prudence*, nor *temperance*, nor *fortitude*, nor *justice*, nor *charity*, &c. for that which is *distinct* from all these is not *virtue*. What then is the import of such *general terms*? The answer is obvious: They denote *classes of objects*; and are never used without some word of limitation, but when something that has no dependence upon the *particular qualities*, which distinguish the individuals from each other, is affirmed or denied of the whole class. Thus we may affirm, that the *three angles of a plain triangle are equal to two right angles*; and this proposition is demonstrably true, not of a triangle, which is neither *oblique nor rectangle*, neither *equilateral nor scalenon*, for such a triangle never was conceived; but of *all these triangles equally*, as the truth of the proposition and the progress of the demonstration has no dependence upon the *peculiarities which distinguish* these triangles from one another. Again, when we say that a man of *virtue will be rewarded by God*, we do not mean by the word *virtue* a general idea making part of each of the complex and more particular ideas of *prudence*, *fortitude*, *justice*, &c. and at the same time different from them all; but we affirm, that the man who practices any or all of these virtues, according as he has opportunity, will be rewarded by God.

The history of our ideas is shortly this:—That act of the mind, if it may be called an *act*, which makes known an *external object*, is termed *PERCEPTION*. That act of the mind which makes known an *internal object*, is termed *CONSCIOUSNESS*. Objects once perceived may be recalled to the mind by the power of memory; and when they are so recalled, we have a perception of them in all respects similar to the original perception, only less distinct; we fancy ourselves in the same place, and the object perceived attended by the same circumstances. This indistinct secondary perception of an object is termed an *IDEA*; and therefore the precise and accurate definition of an *idea*, in contradistinction to an *original perception*, is “that perception of a real object which is raised in the mind by the power of memory.” Now all our *original perceptions* being of *particular objects*, it is obvious that our *ideas*, which are only those perceptions recalled, must be of *particular objects likewise*, and that no man can have an *idea* of a thing of which the *real existence* is contradictory and impossible. But the *general and specific ideas* of logicians, are ideas of *nothing which exists*, or *which can possibly exist*. They are acquired, we are told, by *abstraction*, in the following manner. Among a number of individuals we perceive certain qualities the same in all, whilst in each individual there are other qualities which have nothing similar to them in any other individual: now the mind, it is said, has a power of abstracting the *particular qualities* of each individual from those which are common to the whole, and of these last forming a *general idea* of the whole class. Thus all men have nearly the same form; and they have each some stature and some colour, though there are not perhaps two individuals who have *precisely the same stature and the same colour*. Now, say the advocates for general ideas, if we *abstract* what is peculiar to each individual, and retain what is common to the whole race, we have the *general idea* signified by the word *man*. That is, if we conceive a being in human shape, which is of stature and colour, but neither tall nor short, neither white nor black, nor red nor brown, nor any other colour which we ever saw, we have the *general idea* of *humanity*, and understand the meaning of the word *man*! Surely no person who is not the slave of prejudice will pretend that he can frame such an idea as this—the idea of an object which cannot possibly exist in nature.

By this we do not mean to affirm, that we cannot frame ideas of such objects as have no real existence; for it is as easy to imagine a man with ten heads as with one, because there is nothing contradictory between ten heads and one body. But figures, which is said to be space bounded neither by lines nor superficies; colour, which is neither red nor white, nor blue nor black, &c.; and animal, which is neither man, beast, bird, nor insect; are impossible in nature, and inconceivable in idea. There is, however, no harm in still retaining the phrase *general idea*, provided he who uses it takes care to let it be known, that by these words he means not any abstract and contradictory idea, but merely a class of real objects. The phrase may at times prevent much circumlocution; for which reason we have retained the use of it in the text.

species is formed by superadding some new idea to the species next above it; inasmuch that in this descending scale of our perceptions, the understanding passes through different orders of complex notions, which become more and more complicated at every step it takes. Let us resume here, for instance, the species of plain figures. They imply no more than space bounded by lines. But if we take in an additional consideration of the nature of these lines, as whether they are *right* or *curves*, we fall into the subdivisions of plain figure, distinguished by the names of *rectilinear*, *curvilinear*, and *mixtilinear*.

21 And in all the inferior species, by superadding the specific difference to the nearest genus.

VII. And here we are to observe, that though plain figures, when considered as one of those branches that come under the notion of figure in general, take the name of a species; yet compared with the classes of curvilinear, rectilinear, and mixtilinear, into which they themselves may be divided, they really become a genus, of which the before mentioned subdivisions constitute the several species. These species, in the same manner as in the case of plain and solid figures, consist of the genus and specific difference as their constituent parts. For in the curvilinear kind, the curvity of the lines bounding the figure makes what is called the *specific difference*; to which if we join the genus, which here is a plain figure or space circumscribed by lines, we have all that is necessary towards completing the notion of this species. We are only to take notice, that this last subdivision, having two genera above it, *viz.* plain figures, and figure in general; the genus joined with the specific difference, in order to constitute the species of curvilinears, is that which lies nearest to the said species. It is the notion of plain figure, and not of figure in general, that, joined with the idea of curvity, makes up the complex conception of curve-lined figures. For in this descending scale of our ideas, figure in general, plain figures, curve-lined figures, the two first are considered as genera in respect of the third; and the second in order, or that which stands next to the third, is called the *nearest genus*. But now as it is this second idea, which, joined with the notion of curvity, forms the species of curve-lined figures; it is plain, that the third or last idea in the series is made up of the nearest genus and specific difference. This rule holds invariably, however far the series is continued; because, in a train of ideas thus succeeding one another, all that precede the last are considered as so many genera in respect of that last; and the last itself is always formed by superadding the specific difference to the genus next it.

22 The idea of any individual composed of the lowest species and numeric difference.

VIII. Here then we have a universal description, applicable to all our ideas of whatever kind, from the highest genus to the lowest species. For, taking them in order downwards from the said general idea, they every where consist of the *genus proximum*, and *differentia specifica*, as logicians love to express themselves. But when we come to the lowest species of all, comprehending under it only individuals, the superadded idea, by which these individuals are distinguished one from another, no longer takes the name of the specific difference. For here it serves not to denote distinct species, but merely a variety of individuals, each of which, having a particular existence of its own, is therefore numerically different from every

other of the same kind. And hence it is, that in this last case, logicians choose to call the superadded idea by the name of the *numerical difference*; inasmuch that, as the idea of a species is made up of the nearest genus and specific difference, so the idea of an individual consists of the lowest species and numeric difference. Thus the circle is a species of curve-lined figures, and what we call the *lowest species*, as comprehending under it only individuals. Circles in particular are distinguished from one another by the length and position of their diameters. The length therefore and position of the diameter of a circle form what logicians call the *numerical difference*; because, these being given, the circle itself may be described, and an individual thereby constituted.

IX. Thus the mind, in compounding its ideas, begins, we see, with the most general notions, which, consisting of but a few simple notions, are easily combined and brought together into one conception. Thence it proceeds to the species comprehended under this general idea, and these are formed by joining together the genus and specific difference. And as it often happens, that these species may be still farther subdivided, and run on in a long series of continued gradations, producing various orders of compound perceptions; so all these several orders are regularly and successively formed by annexing in every step the specific difference to the nearest genus. When by this method of procedure we are come to the lowest order of all, by joining the species and numeric difference, we frame the ideas of individuals. And here the series necessarily terminates, because it is impossible any farther to bound or limit our conceptions. This view of the composition of our ideas, representing their constituent parts in every step of the progression, naturally points out the true and genuine form of a definition. For as definitions are no more than descriptions of the ideas for which the terms defined stand; and as ideas are then described, when we enumerate distinctly and in order the parts of which they consist; it is plain, that by making our definitions follow one another according to the natural train of our conceptions, they will be subject to the same rules, and keep pace with the ideas they describe.

X. As therefore the first order of our compound notions, or the ideas that constitute the highest genera in the different scales of perception, are formed by uniting together a certain number of simple notions; so the terms expressing these genera are defined by enumerating the simple notions so combined. And as the species comprehended under any genus, or the complex ideas of the second order, arise from superadding the specific difference to the said general idea; so the definition of the names of the species is abolished, in a detail of the ideas of the specific difference, connected with the term of the genus. For the genus having been before defined, the term by which it is expressed stands for a known idea, and may therefore be introduced into all subsequent definitions, in the same manner as the names of simple perceptions. It will now be sufficiently obvious, that the definitions of all the succeeding orders of compound notions will every where consist of the term of the nearest genus, joined with an enumeration of the ideas that constitute the specific

23 Definitions to follow one another in train, and pass thro' the five gradations as out ideas.

24 The form of a definition in all the various orders of conception.

specific difference; and that the definition of individuals unites the names of the lowest species with the terms by which we express the ideas of the numeric difference.

XI. Here then we have the true and proper form

of a definition, in all the various orders of conception. This is that method of defining which is commonly called *logical*, and which we see is perfect in its kind, inasmuch as it presents a full and adequate description of the idea for which the term defined stands.

PART II. OF JUDGMENT.

CHAP. I. Of the Grounds of Human Judgment.

25
Intuition respects the relations between our ideas when they are immediately perceptible.

THE mind being furnished with ideas, its next step in the way to knowledge is, the comparing these ideas together, in order to judge of their agreement or disagreement. In this joint view of our ideas, if the relation is such as to be immediately discoverable by the bare inspection of the mind, the judgments then obtained are called *intuitions*, from a word that denotes to *look at*; for in this case, a mere attention to the ideas compared suffices to let us see how far they are connected or disjointed. Thus, *that the Whole is greater than any of its Parts*, is an intuitive judgment; nothing more being required to convince us of its truth, than an attention to the ideas of *whole* and *part*. And this too is the reason why we call the act of the mind forming these judgments *intuition*; as it is indeed no more than an immediate perception of the agreement or disagreement of any two ideas.

26
Experience and testimony only the ground of judging as to facts.

II. But here it is to be observed, that our knowledge of this kind respects only our ideas, and the relations between them; and therefore can serve only as a foundation to such reasonings as are employed in investigating those relations. Now it so happens, that many of our judgments are conversant about facts, and the real existence of things, which cannot be traced by the bare contemplation of our ideas. It does not follow, because I have the idea of a circle in my mind, that therefore a figure answering to that idea has a real existence in nature. I can form to myself the notion of a centaur or golden mountain, but never imagine on that account that either of them exists. What then are the grounds of our judgment in relation to facts? *experience* and *testimony*. By experience we are informed of the existence of the several objects which surround us, and operate upon our senses. Testimony is of a wider extent, and reaches not only to objects beyond the present sphere of our observation, but also to facts and transactions, which being now past, and having no longer any existence, could not without this conveyance have fallen under our cognizance.

27
Three foundations of human judgment, viz. 1. Intuition, the ground of scientific knowledge.

III. Here we have three foundations of human judgment, from which the whole system of our knowledge may with ease and advantage be derived. First, intuition, which respects our ideas themselves, and their relations; and is the foundation of that species of reasoning which we call *demonstration*. For whatever is deduced from our intuitive perceptions, by a clear and connected series of proofs, is said to be demonstrated, and produces absolute certainty in the mind. Hence the knowledge obtained in this manner is what we properly term *science*; because in every step of the procedure it carries its own evidence along with it, and leaves no room for doubt or hesitation.

And what is highly worthy of notice; as the truths of this class express the relation between our ideas, and the same relations must ever and invariably subsist between the same ideas, our deductions in the way of science constitute what we call *eternal, necessary, and immutable truths*. If it be true that the whole is equal to all its parts, it must be so unchangeably; because the relation of equality being attached to the ideas themselves, must ever intervene where the same ideas are compared. Of this nature are all the truths of natural religion, morality, and mathematics, and in general whatever may be gathered from the bare view and consideration of our ideas.

IV. The second ground of human judgment is *experience*; from which we infer the existence of those subjects that surround us, and fall under the immediate notice of our senses. When we see the sun, or cast our eyes towards a building, we not only have perceptions of these objects within ourselves, but ascribe to them a real existence out of the mind. It is also by the information of the senses that we judge of the qualities of bodies; as when we say that *snow is white, fire hot, or steel hard*. For as we are wholly unacquainted with the internal structure and constitution of the bodies that produce these sensations in us, nay, and are unable to trace any connection between that structure and the sensations themselves, it is evident, that we build our judgments altogether upon observation, ascribing to bodies such qualities as are answerable to the perceptions they excite in us. Not that we ever suppose the qualities of bodies to be things of the same nature with our perceptions; for there is nothing in fire similar to our sensation of heat, or in a sword similar to pain: but that when different bodies excite in our minds similar perceptions, we necessarily ascribe to these bodies not only an existence independent of us, but likewise similar qualities, of which it is the nature to produce similar perceptions in the human mind. But this is not the only advantage derived from experience; for to that too we are indebted for all our knowledge regarding the coexistence of sensible qualities in objects, and the operations of bodies one upon another. Ivory, for instance, is hard and elastic; this we know by experience, and indeed by that alone. For, being altogether strangers to the true nature both of elasticity and hardness, we cannot by the bare contemplation of our ideas determine how far the one necessarily implies the other, or whether there may not be a repugnance between them. But when we observe them to exist both in the same object, we are then assured from experience that they are not incompatible; and when we also find, that a stone is hard and not elastic, and that air though elastic is not hard, we also conclude upon the same foundation, that the ideas are not necessarily conjoined,

but may exist separately in different objects. In like manner with regard to the operations of bodies one upon another, it is evident, that our knowledge this way is all derived from observation. *Aquaregia* dissolves gold, as has been found by frequent trial, nor is there any other way of arriving at the discovery. Naturalists may tell us, if they please, that the parts of *aquaregia* are of a texture apt to insinuate between the corpuscles of gold, and thereby loosen and shake them asunder. If this is a true account of the matter, it will notwithstanding be allowed, that our conjecture in regard to the conformation of these bodies is deduced from the experiment, and not the experiment from the conjecture. It was not from any previous knowledge of the intimate structure of *aquaregia* and gold, and the aptness of their parts to act or to be acted upon, that we came by the conclusion above mentioned. The internal constitution of bodies is in a manner wholly unknown to us; and could we even surmount this difficulty, yet as the separation of the parts of gold implies something like an active force in the *menstruum*, and we are unable to conceive how it comes to be possessed of this activity, the effect must be owned to be altogether beyond our comprehension. But when repeated trials had once confirmed it, inasmuch that it was admitted as an established truth in natural knowledge, it was then easy for men to spin out theories of their own invention, and contrive such a structure of parts, both for *gold* and *aquaregia*, as would best serve to explain the phenomenon upon the principles of that system of philosophy they had adopted.

V. From what has been said it is evident, that as intuition is the foundation of what we call *scientific* knowledge, so is experience of *natural*. For this last being wholly taken up with objects of sense, or those bodies that constitute the natural world; and their properties, as far as we can discover them, being to be traced only by a long and painful series of observations; it is apparent, that, in order to improve this branch of knowledge, we must betake ourselves to the method of trial and experiment.

VI. But though experience is what we may term the immediate foundation of natural knowledge, yet with respect to particular persons its influence is very narrow and confined. The bodies that surround us are numerous, many of them lie at a great distance, and some quite beyond our reach. Life is so short, and so crowded with cares, that but little time is left for any single man to employ himself in unfolding the mysteries of nature. Hence it is necessary to admit many things upon the testimony of others, which by this means becomes the foundation of a great part of our knowledge of body. No man doubts of the power of *aquaregia* to dissolve gold, though perhaps he never himself made the experiment. In these therefore and such like cases we judge of the facts and operations of nature upon the mere ground of testimony. However, as we can always have recourse to experience where any doubt or scruple arises, this is justly considered as the true foundation of natural philosophy; being indeed the ultimate support upon which our assent rests, and whereto we appeal when the highest degree of evidence is required.

VII. But there are many facts that will not allow

of an appeal to the senses; and in this case testimony is the true and only foundation of our judgments. All human actions of whatever kind, when considered as already past, are of the nature here described; because having now no longer any existence, both the facts themselves, and the circumstances attending them, can be known only from the relations of such as had sufficient opportunities of arriving at the truth. *Testimony* therefore is justly accounted a third ground of human judgment; and as from the other two we have deduced *scientific* and *natural* knowledge, so we may from this derive *historical*; by which we mean, not merely a knowledge of the civil transactions of states and kingdoms, but of all facts whatsoever, where testimony is the ultimate foundation of our belief.

CHAP. II. Of Affirmative and Negative Propositions.

I. WHILE the comparing of our ideas is considered merely as an act of the mind, assembling them together, and joining or disjoining them according to the result of its perceptions, we call it *judgment*; but when our judgments are put into words, they then bear the name of *propositions*. A proposition therefore is a sentence expressing some judgment of the mind, whereby two or more ideas are affirmed to agree or disagree. Now, as our judgments include at least two ideas, one of which is affirmed or denied of the other, so must a proposition have terms answering to these ideas. The idea of which we affirm or deny, and of course the term expressing that idea, is called the *subject* of the proposition. The idea affirmed or denied, as also the term answering it, is called the *predicate*. Thus in the proposition, *God is omnipotent*: *God* is the subject, it being of him that we affirm omnipotence; and *omnipotent* is the predicate, because we affirm the idea expressed by that word to belong to God.

II. But as, in propositions, ideas are either joined or disjoined; it is not enough to have terms expressing those ideas, unless we have also some words to denote their agreement or disagreement. That word in a proposition, which connects two ideas together, is called the *copula*; and if a negative particle be annexed, we thereby understand that the ideas are disjoined. The *substantive verb* is commonly made use of for the copula: as in the above-mentioned proposition, *God is omnipotent*; where *is* represents the copula, and signifies the agreement of the ideas of *God* and *omnipotence*. But if we mean to separate two ideas; then, besides the substantive verb, we must also use some particle of negation, to express this repugnance. The proposition, *man is not perfect*, may serve as an example of this kind; where the notion of *perfection* being removed from the idea of *man*, the negative particle *not* is inserted after the copula, to signify the disagreement between the subject and predicate.

III. Every proposition necessarily consists of these three parts: but then it is not alike needful that they be all severally expressed in words; because the copula is often included in the term of the predicate, as when a single word, *he sits*; which imports the same as *he is sitting*. In the Latin language, a single word has often the force of a whole sentence. Thus *ambulat* is the same as *ille est ambulans*; *amo*, as *ego sum amans*; and so in

innumerable other instances: by which it appears, that we are not so much to regard the number of words in a sentence, as the ideas they represent, and the manner in which they are put together. For wherever two ideas are joined or disjoined in an expression, tho' of but a single word; it is evident that we have a subject, predicate, and copula, and of consequence a complete proposition.

33
Affirmative
and negative
proposi-
tions.

IV. When the mind joins two ideas, we call it an *affirmative* judgment; when it separates them, a *negative*: and as any two ideas compared together must necessarily either agree or not agree, it is evident that all our judgments fall under these two divisions. Hence likewise the propositions expressing these judgments are all either affirmative or negative. An affirmative proposition connects the predicate with the subject, as *a stone is heavy*; a negative proposition separates them, as *God is not the author of evil*. Affirmation therefore is the same as joining two ideas together, and this is done by means of the copula. Negation on the contrary marks a repugnance between the ideas compared; in which case a negative particle must be called in, to show that the connection included in the copula does not take place.

34
When the
negative
particle
serves to
disjoin
ideas.

V. Hence we see the reason of the rule commonly laid down by logicians, That in all negative propositions the negation ought to affect the copula. For as the copula, when placed by itself, between the subject and the predicate, manifestly binds them together; it is evident, that in order to render a proposition negative, the particles of negation must enter it in such a manner as to destroy this union. In a word, then only are two ideas disjoined in a proposition, when the negative particle may be so referred to the copula, as to break the affirmation included in it, and undo that connection it would otherwise establish. When we say, for instance, *No man is perfect*; take away the negation, and the copula of itself plainly unites the ideas in the proposition. But as this is the very reverse of what is intended, a negative mark is added, to show that this union does not here take place. The negation, therefore, by destroying the effect of the copula, changes the very nature of the proposition, inasmuch that, instead of binding two ideas together, it denotes their separation. On the contrary, in this sentence, *The man who departs not from an upright behaviour is beloved of God*, the predicate *beloved of God* is evidently affirmed of the subject *an upright man*; so that, notwithstanding the negative particle, the proposition is still affirmative. The reason is plain: the negation here affects not the copula; but, making properly a part of the subject, serves, with other terms in the sentence, to form one complex idea, of which the predicate *beloved of God* is directly affirmed.

CHAP. III. Of Universal and Particular Propositions.

I. THE next considerable division of propositions is

into *universal* and *particular*. Our ideas, according to what has been already observed in the First Part, are all singular as they enter the mind, and represent individual objects. But as by abstraction we can render them universal, so as to comprehend a whole class of things, and sometimes several classes at once; hence the terms expressing these ideas must be in like manner universal. If therefore we suppose any general term to become the subject of a proposition, it is evident, that whatever is affirmed of the abstract idea belonging to that term, may be affirmed of all the individuals to which that idea extends. Thus, when we say, *Men are mortal*; we consider mortality, not as confined to one or any number of particular men, but as what may be affirmed without restriction of the whole species. By this means the proposition becomes as general as the idea which makes the subject of it; and indeed derives its universality entirely from that idea, being more or less so according as this may be extended to more or fewer individuals. But it is further to be observed of these general terms, that they sometimes enter a proposition in their full latitude, as in the example given above; and sometimes appear with a mark of limitation. In this last case we are given to understand, that the predicate agrees not to the whole universal idea, but only to a part of it; as in the proposition, *Some men are wise*: For here wisdom is not affirmed of every particular man, but restrained to a few of the human species (B).

II. Now from this different appearance of the general idea that constitutes the subject of any judgment, arises the division of propositions into *universal* and *particular*. An universal proposition is that wherein the subject is some general term taken in its full latitude; inasmuch that the predicate agrees to all the individuals comprehended under it, if it denotes a proper species; and to all the several species, and their individuals, if it marks an idea of a higher order. The words *all*, *every*, *no*, *none*, &c. are the proper signs of this universality; and as they seldom fail to accompany general truths, so they are the most obvious criterion whereby to distinguish them. *All animals have a power of beginning motion*. This is an universal proposition; as we know from the word *all* prefixed to the subject *animals*, which denotes that it must be taken in its full extent. Hence the power of beginning motion may be affirmed of all the several species of animals.

III. A particular proposition has in like manner some general term for its subject; but with a mark of limitation added, to denote, that the predicate agrees only to some of the individuals comprehended under a species, or to one or more of the species belonging to any genus, and not to the whole universal idea. Thus, *Some stones are heavier than iron*: *Some men have an uncommon share of prudence*. In the last of these propositions, the subject *some men* implies only a certain number.

36
Proposi-
tions uni-
versal where
the subject
is so, with-
out a mark
of restric-
tion.

37
Proposi-
tions parti-
cular where
some uni-
versal sub-
ject appears
with a mark
of limita-
tion.

(B) See the preceding note, where it is demonstrated that the *terms* alone, and not the *ideas*, are in reality general. The term *man* is equally applicable to every individual of the human race; and therefore, what is affirmed or denied of *men* in general, is affirmed or denied of all the individuals, without regard to their discriminating qualities. *Some* is a definitive word (see GRAMMAR), which, prefixed to the word *man*, limits the signification of that general term; and therefore what is affirmed of *some men*, is affirmed only of *part* of the race, but that part itself is not ascertained.

ber of individuals, comprehended under a single species. In the former, where the subject is a genus that extends to a great variety of distinct classes, *some stones* may not only imply any number of particular stones, but also several whole species of stones, inasmuch as there may be not a few with the property there described. Hence we see, that a proposition does not cease to be particular by the predicate's agreeing to a whole species, unless that species, singly and distinctly considered, makes also the subject of which we affirm or deny.

38
Singular propositions contained under the head of particulars

IV. There is still one species of propositions that remains to be described, and which the more deserves our notice, as it is not yet agreed among logicians to which of the two classes mentioned above they ought to be referred; namely, *singular propositions*, or those where the subject is an individual. Of this nature are the following: *Sir Isaac Newton was the inventor of fluxions; This book contains many useful truths.* What occasions some difficulty as to the proper rank of these propositions is, that, the subject being taken according to the whole of its extension, they sometimes have the same effect in reasoning as universals. But if it be considered that they are in truth the most limited kind of particular propositions, and that no proposition can with any propriety be called universal but where the subject is some universal idea; we shall not be long in determining to which class they ought to be referred. When we say, *Some books contain useful truths*; the proposition is particular, because the general term appears with a mark of restriction. If therefore we say, *This book contains useful truths*; it is evident that the proposition must be still more particular, as the limitation implied in the word *this* is of a more confined nature than in the former case.

39
The fourfold division of propositions.

V. We see, therefore, that all propositions are either *affirmative or negative*; nor is it less evident, that in both cases they may be *universal or particular*. Hence arises that celebrated fourfold division of them into *universal affirmative and universal negative, particular affirmative and particular negative*, which comprehends indeed all their varieties. The use of this method of distinguishing them will appear more fully afterwards, when we come to treat of reasoning and syllogism.

CHAP. IV. Of Absolute and Conditional Propositions.

40
Distinction of qualities into essential and accidental.

I. THE objects about which we are chiefly conversant in this world, are all of a nature liable to change. What may be affirmed of them at one time, cannot often at another; and it makes no small part of our knowledge to distinguish rightly these variations, and trace the reasons upon which they depend. For it is observable, that amidst all the vicissitude of nature, some things remain constant and invariable; nor even are the changes, to which we see others liable, effected but in consequence of uniform and steady laws, which, when known, are sufficient to direct us in our judgments about them. Hence philosophers, in distinguishing the objects of our perception into various classes, have been very careful to note, that some properties belong essentially to the general idea, so as not to be separable from it but by destroying its very nature; while others are only accidental, and may be affirmed or denied of it in different circumstances.

N^o 185.

Thus solidity, a yellow colour, and great weight, are considered as essential qualities of gold; but whether it shall exist as an uniform conjoined mass, is not unlike necessary. We see that by a proper menstruum it may be reduced to a fine powder, and that an intense heat will bring it into a state of fusion.

II. From this diversity in the several qualities of things arises a considerable difference as to the manner of our judging about them. For all such properties as are inseparable from objects when considered as belonging to any genus or species, are affirmed absolutely and without reserve of that general idea. Thus we say, *Gold is very weighty; A stone is hard; Animals have a power of self-motion.* But in the case of mutual or accidental qualities, as they depend upon some other consideration distinct from the general idea; that also must be taken into the account, in order to form an accurate judgment. Should we affirm, for instance, of some stones, that they are very fusible of a rolling motion; the proposition, while it remains in this general form, cannot with any advantage be introduced into our reasonings. An aptness to receive that mode of motion flows from the figure of the stone; which, as it may vary infinitely, our judgment then only becomes applicable and determinate, when the particular figure, of which volubility is a consequence, is also taken into the account. Let us then bring in this other consideration, and the proposition will run as follows: *Stones of a spherical form are easily put into a rolling motion.* Here we see the condition upon which the predicate is affirmed, and therefore know in what particular cases the proposition may be applied.

III. This consideration of propositions respecting the manner in which the predicate is affirmed of the subject gives rise to the division of them into *absolute and conditional*. *Absolute* propositions are those where, in we affirm some property inseparable from the idea of the subject, and which therefore belongs to it in all possible cases: as, *God is infinitely wise; Virtue tends to the ultimate happiness of man.* But where the predicate is not necessarily connected with the idea of the subject, unless upon some consideration distinct from that idea, there the proposition is called *conditional*. The reason of the name is taken from the supposition annexed, which is of the nature of a condition, and may be expressed as such, thus: *If a stone is exposed to the rays of the sun, it will contract some degree of heat; If a river runs in a very declining channel, its rapidity will constantly increase.*

IV. There is not any thing of greater importance in philosophy than a due attention to this division of propositions. If we are careful never to affirm things of absolutely but where the ideas are inseparably conjoined; and if in our other judgments we distinctly mark the conditions which determine the predicate to belong to the subject; we shall be the less liable to mistake in applying general truths to the particular concerns of human life. It is owing to the exact observance of this rule that mathematicians have been so happy in their discoveries, and that what they demonstrate of magnitude in general may be applied with ease in all obvious occurrences.

V. The truth of it is, particular propositions are then known to be true, when we can trace their connection

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And reduc-
es them
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nection with universals; and it is accordingly the great business of science to find out general truths that may be applied with safety in all obvious instances. Now the great advantage arising from determining with care the conditions upon which one idea may be affirmed or denied of another is this: that thereby particular propositions really become universal, may be introduced with certainty into our reasonings, and serve as standards to conduct and regulate our judgments. To illustrate this by a familiar instance: if we say, *Some water acts very forcibly*; the proposition is particular: and as the conditions on which this forcible action depends are not mentioned, it is as yet uncertain in what cases it may be applied. Let us then supply these conditions, and the proposition will run thus: *Water conveyed in sufficient quantity along a steep descent acts very forcibly*. Here we have an universal judgment, inasmuch as the predicate forcible action may be ascribed to all water under the circumstances mentioned. Nor is it less evident that the proposition in this new form is of easy application; and in fact we find that men do apply it in instances where the forcible action of water is required; as in corn-mills and many other works of art.

CHAP. V. Of Simple and Compound Propositions.

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Division of
proposi-
tions into
simple and
compound.

I. HITHERTO we have treated of propositions, where only two ideas are compared together. These are in the general called *simple*; because, having but one subject and one predicate, they are the effect of a simple judgment that admits of no subdivision. But if it so happens that several ideas offer themselves to our thoughts at once, whereby we are led to affirm the same thing of different objects, or different things of the same object; the propositions expressing these judgments are called *compound*: because they may be resolved into as many others as there are subjects or predicates in the whole complex determination on the mind. Thus, *God is infinitely wise and infinitely powerful*. Here there are two predicates, *infinite wisdom and infinite power*, both affirmed of the same subject; and accordingly the proposition may be resolved into two others, affirming these predicates severally. In like manner in the proposition, *Neither kings nor people are exempt from death*; the predicate is denied of both subjects, and may therefore be separated from them in distinct propositions. Nor is it less evident, that if a complex judgment consists of several subjects and predicates, it may be resolved into as many simple propositions as are the number of different ideas compared together. *Riches and honours are apt to elate the mind, and increase the number of our desires*. In this judgment there are two subjects and two predicates, and it is at the same time apparent that it may be resolved into four distinct propositions. *Riches are apt to elate the mind. Riches are apt to increase the number of our desires. And so of honours*.

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The proper
notion of a
compound
proposition
ascertained

II. Logicians have divided these compound propositions into a great many different classes; but, in our opinion, not with a due regard to their proper definition. Thus *conditionals, causals, relatives, &c.* are mentioned as so many distinct species of this kind, though in fact they are no more than simple propositions. To give an instance of a conditional; *If a stone is exposed to the rays of the sun, it will contract*

some degree of heat. Here we have but one subject and one predicate; for the complex expression, *A stone exposed to the rays of the sun*, constitutes the proper subject of this proposition, and is no more than one determined idea. The same thing happens in causals. *Rehobam was unhappy because he followed evil counsel*. There is here an appearance of two propositions arising from the complexity of the expression; but when we come to consider the matter more nearly, it is evident that we have but a single subject and predicate. *The pursuit of evil counsel brought misery upon Rehobam*. It is not enough, therefore, to render a proposition compound, that the subject and predicate are complex notions, requiring sometimes a whole sentence to express them: for in this case the comparison is still confined to two ideas, and constitutes what we call a simple judgment. But where there are several subjects or predicates, or both, as the affirmation or negation may be alike extended to them all, the proposition expressing such a judgment is truly a collection of as many simple ones as there are different ideas compared. Confining ourselves therefore to this more strict and just notion of compound propositions, they are all reducible to two kinds, viz. *copulatives and disjunctives*.

III. A *copulative* proposition is, where the subjects ⁴⁷Compound and predicates are so linked together, that they may proposition be all severally affirmed or denied one of another. Of ⁴⁸disjunctive, either copulative; this nature are the examples of compound propositions given above. *Riches and honours are apt to elate the mind, and increase the number of our desires. Neither kings nor people are exempt from death*. In the first of these the two predicates may be affirmed severally of each subject, whence we have four distinct propositions. The other furnishes an example of the negative kind, where the same predicate, being disjoined from both subjects, may be also denied of them in separate propositions.

IV. The other species of compound propositions are those called *disjunctives*; in which, comparing several predicates with the same subject; we affirm that one of them necessarily belongs to it, but leave the particular predicate undetermined. If any one, for example, says, *This world either exists of itself, or is the work of some all-wise and powerful cause*, it is evident that one of the two predicates must belong to the world; but as the proposition determines not which, it is therefore of the kind we call *disjunctive*. Such too are the following: *The sun either moves round the earth, or is the centre about which the earth revolves. Friendship finds men equal, or makes them so*. It is the nature of all propositions of this class, supposing them to be exact in point of form, that upon determining the particular predicate, the rest are of course to be removed; or if all the predicates but one are removed, that one necessarily takes place. Thus, in the example given above; if we allow the world to be the work of some wise and powerful cause, we of course deny it to be self-existent; or if we deny it to be self-existent, we must necessarily admit that it was produced by some wise and powerful cause. Now this particular manner of linking the predicates together, so that the establishing one displaces all the rest; or the excluding all but one necessarily establishes that one; cannot otherwise be effected than by means of *disjunctive* C c

judice particles. And hence it is that propositions of this class take their names from these particles which make so necessary a part of them, and indeed constitute their very nature considered as a distinct species.

CHAP VI. Of the Division of Propositions into Self-evident and Demonstrable.

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Propositions divided into self-evident and demonstrable.

I. WHEN any proposition is offered to the view of the mind, if the terms in which it is expressed be understood; upon comparing the ideas together, the agreement or disagreement asserted is either immediately perceived, or found to lie beyond the present reach of the understanding. In the first case the proposition is said to be *self-evident*, and admits not of any proof, because a bare attention to the ideas themselves produces full conviction and certainty; nor is it possible to call in any thing more evident by way of confirmation. But where the connection or repugnance comes not so readily under the inspection of the mind, there we must have recourse to reasoning; and if by a clear series of proofs we can make out the truth proposed, inasmuch that self-evidence shall accompany every step of the procedure, we are then able to demonstrate what we assert, and the proposition itself is said to be *demonstrable*. When we affirm, for instance, that it is impossible for the same thing to be and not to be; whoever understands the terms made use of perceives at first glance the truth of what is asserted, nor can he by any efforts bring himself to believe the contrary. The proposition therefore is *self-evident*, and such that it is impossible by reasoning to make it plainer; because there is no truth more obvious or better known, from which as a consequence it may be deduced. But if we say, *This world had a beginning*; the assertion is indeed equally true, but shines not forth with the same degree of evidence. We find great difficulty in conceiving how the world could be made out of nothing: and are not brought to a free and full consent, until by reasoning we arrive at a clear view of the absurdity involved in the contrary supposition. Hence this proposition is of the kind we call *demonstrable*, inasmuch as its truth is not immediately perceived by the mind, but yet may be made appear by means of others more known and obvious, whence it follows as an unavoidable consequence.

II. From what has been said, it appears, that reasoning is employed only about demonstrable propositions, and that our intuitive and self-evident perceptions are the ultimate foundation on which it rests.

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Self-evident truths the first principles of reasoning.

III. Self-evident propositions furnish the first principles of reasoning; and it is certain, that if in our researches we employ only such principles as have this character of self-evidence, and apply them according to the rules to be afterwards explained, we shall be in no danger of error in advancing from one discovery to another. For this we may appeal to the writings of the mathematicians, which being conducted by the express model here mentioned, are an incontestable proof of the firmness and stability of human knowledge, when built upon so sure a foundation. For not only have the propositions of this science stood the test of ages; but are found attended with that invincible evidence, as forces the assent of all who duly con-

sider the proofs upon which they are established. Since the mathematicians are universally allowed to have hit upon the right method of arriving at unknown truths, since they have been the happiest in the choice as well as the application of their principles, it may not be amiss to explain here their method of stating self-evident propositions, and applying them to the purposes of demonstration.

IV. First then it is to be observed, that they have been very careful in ascertaining their ideas, and fixing the signification of their terms. For this purpose they begin with *definitions*, in which the meaning of their words is so distinctly explained, that they can never fail to excite in the mind of an attentive reader the very same ideas as are annexed to them by the writer. And indeed the clearness and irrefragable evidence of mathematical knowledge is owing to nothing so much as this care in laying the foundation. Where the relation between any two ideas is accurately and justly traced, it will not be difficult for another to comprehend that relation, if in setting himself to discover it he brings the very same ideas into comparison. But if, on the contrary, he affixes to his words ideas different from those that were in the mind of him who first advanced the demonstration; it is evident, that as the same ideas are not compared, the same relation cannot subsist, inasmuch that a proposition will be rejected as false, which, had the terms been rightly understood, must have appeared incontestably true. A square, for instance, is a figure bounded by four equal right lines, joined together at right angles. Here the nature of the angles makes no less a part of the idea than the equality of the sides; and many properties demonstrated of the square flow entirely from its being a rectangular figure. If therefore we suppose a man, who has formed a partial notion of a square, comprehending only the equality of its sides, without regard to the angles, reading some demonstration that implies also this latter consideration; it is plain he would reject it as not universally true, inasmuch as it could not be applied where the sides were joined together at equal angles. For this last figure, answering still to his idea of a square, would be yet found without the property assigned to it in the proposition. But if he comes afterwards to correct his notion, and render his idea complete, he will then readily own the truth and justness of the demonstration.

V. We see, therefore, that nothing contributes so much to the improvement and certainty of human knowledge, as the having determinate ideas, and keeping them steady and invariable in all our discourses and reasonings about them. And on this account it is, that mathematicians, as was before observed, always begin by defining their terms, and distinctly unfolding the notions they are intended to express. Hence such as apply themselves to these studies have exactly the same views of things; and, bringing always the very same ideas into comparison, readily discern the relations between them. It is likewise of importance, in every demonstration, to express the same idea invariably by the same word. From this practice mathematicians never deviate; and if it be necessary in their demonstrations, where the reader's comprehension is aided by a diagram, it is much more so in all reasonings about moral or intellectual truths where the ideas

cannot be represented by a diagram. The observation of this rule may sometimes be productive of ill-sounding periods; but when *truth* is the object, *found* ought to be despised.

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The establishing of principles, the consequence, in mathematical knowledge.

VI. When the mathematicians have taken this first step, and made known the ideas whose relations they intend to investigate; their next care is, to lay down some self-evident truths, which may serve as a foundation for their future reasonings. And here indeed they proceed with remarkable circumspection, admitting no principles but what flow immediately from their definitions, and necessarily force themselves upon a mind in any degree attentive to its ideas. Thus a *circle* is a figure formed by a right line moving round some fixed point in the same plane. The fixed point round which the line is supposed to move, and where one of its extremities terminates, is called the *centre* of the circle. The other extremity, which is conceived to be carried round until it returns to the point whence it first set out, describes a curve running into itself, and termed the *circumference*. All right lines drawn from the centre to the circumference are called *radii*. From these definitions compared, geometers derive this self-evident truth; *that the radii of the same circle are all equal to one another*.

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Propositions divided into speculative and practical.

VII. We now observe, that in all propositions we either affirm or deny some property of the idea that constitutes the subject of our judgment, or we maintain that something may be done or effected. The first sort are called *speculative* propositions, as in the example mentioned above, the *radii of the same circle are all equal to one another*. The others are called *practical*, for a reason too obvious to be mentioned; thus, *that a right line may be drawn from one point to another* is a practical proposition; inasmuch as it expresses that something may be done.

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Hence mathematical principles distinguished into axioms and postulates.

VIII. From this twofold consideration of propositions arises the twofold division of mathematical principles into axioms and postulates. By an *axiom* they understand any self-evident speculative truth; as, *That the whole is greater than its parts: That things equal to one and the same thing are equal to one another*. But a self-evident practical proposition is what they call a *postulate*. Such are those of Euclid; *that a finite right line may be continued directly forwards; that a circle may be described about any centre with any distance*. And here we are to observe, that as in an axiom the agreement or disagreement between the subject and predicate must come under the immediate inspection of the mind; so in a postulate, not only the possibility of the thing asserted must be evident at first view, but also the manner in which it may be effected. For where this manner is not of itself apparent, the proposition comes under the notion of the demonstrable

kind, and is treated as such by geometrical writers. Thus, *to draw a right line from one point to another*, is assumed by Euclid as a postulate, because the manner of doing it is so obvious, as to require no previous teaching. But then it is not equally evident, how we are to construct an equilateral triangle. For this reason he advances it as a demonstrable proposition, lays down rules for the exact performance, and at the same time proves, that if these rules are followed, the figure will be justly described.

IX. This leads us to take notice, that as self-evident truths are distinguished into different kinds, according as they are speculative or practical; so is it also with demonstrable propositions. A demonstrable speculative proposition is by mathematicians called a *theorem*. Such is the famous 47th proposition of the first book of the elements, known by the name of the *Pythagoric theorem*, from its supposed inventor Pythagoras, viz. "that in every right-angled triangle, the square described upon the side subtending the right-angle is equal to both the squares described upon the sides containing the right-angle." On the other hand, a demonstrable practical proposition is called a *problem*; as where Euclid teaches us to describe a square upon a given right-line.

X. It may not be amiss to add, that, besides the four kinds of propositions already mentioned, mathematicians have also a fifth, known by the name of *corollaries*. These are usually subjoined to theorems or problems, and differ from them only in this; that they flow from what is there demonstrated in so obvious a manner as to discover their dependence upon the proposition whence they are deduced, almost as soon as proposed. Thus Euclid having demonstrated, "that in every right-lined triangle all the three angles taken together are equal to two right-angles;" adds by way of corollary, "that all the three angles of any one triangle taken together are equal to all the three angles of any other triangle taken together;" which is evident at first sight; because in all cases they are equal to two right ones, and things equal to one and the same thing are equal to one another.

XI. The scholars of mathematicians are indifferently annexed to definitions, propositions, or corollaries; and answer the same purposes as annotations upon a classic author. For in them occasion is taken to explain whatever may appear intricate and obscure in a train of reasoning; to answer objections; to teach the application and uses of propositions; to lay open the original and history of the several discoveries made in the science; and, in a word, to acquaint us with all such particulars as deserve to be known, whether considered as points of curiosity or profit.

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Remote relations discovered by means of intermediate ideas.

XII. When, for instance, we compare two figures of a different make, in order to judge of their equality or inequality, it is plain, that by barely considering the figures themselves, we cannot arrive at an exact determination; because, by reason of their disagreeing forms, it is impossible so to put them together, as that their several parts shall mutually coincide. Here then it be-

PART III. OF REASONING.

CHAP. I. Of Reasoning in general, and the Parts of which it consists.

IT often happens in comparing ideas together, that their agreement or disagreement cannot be discerned at first view, especially if they are of such a nature as not to admit of an exact application one to another.

⁵⁹
Remote relations discovered by means of intermediate ideas.

comes necessary to look out for some third idea that will admit of such an application as the present case requires; wherein if we succeed, all difficulties vanish, and the relation we are in quest of may be traced with ease. Thus right-lined figures are all reduced to squares, by means of which we can measure their areas, and determine exactly their agreement or disagreement in point of magnitude.

60
This manner of arriving at truth termed reasoning.

II. But how can any third idea serve to discover a relation between two others? The answer is, By being compared severally with these others; for such a comparison enables us to see how far the ideas with which this third is compared are connected or disjointed between themselves. In the example mentioned above of two right-lined figures, if we compare each of them with some square whose area is known, and find the one exactly equal to it, and the other less by a square inch, we immediately conclude that the area of the first figure is a square inch greater than that of the second. This manner of determining the relation between any two ideas, by the intervention of some third with which they may be compared, is that which we call *reasoning*; and is indeed the chief instrument by which we push on our discoveries, and enlarge our knowledge. The great art lies in finding out such intermediate ideas, as, when compared with the others in the question, will furnish evident and known truths; because, as will afterwards appear, it is only by means of them that we arrive at the knowledge of what is hidden and remote.

61
The parts that constitute an act of reasoning and a syllogism.

III. Hence it appears, that every act of reasoning necessarily includes three distinct judgments; two wherein the ideas whose relation we want to discover are severally compared with the middle idea, and a third wherein they are themselves connected or disjointed, according to the result of that comparison. Now, as in the second part of logic our judgments, when put into words, were called propositions, so here in the third part the expressions of our reasonings are termed *syllogisms*. And hence it follows, that as every act of reasoning implies three several judgments, so every syllogism must include three distinct propositions. When a reasoning is thus put into words, and appears in form of a syllogism, the intermediate idea made use of, to discover the agreement or disagreement we search for, is called the *middle term*; and the two ideas themselves, with which this third is compared, go by the name of the *extremes*.

62
Inference, man and accountable nouns.

IV. But as these things are best illustrated by examples; let us, for instance, set ourselves to inquire *whether men are accountable for their actions*. As the relation between the ideas of *man* and *accountableness* comes not within the immediate view of the mind, our first care must be to find out some third idea that will enable us the more easily to discover and trace it. A very small measure of reflection is sufficient to inform us, that no creature can be accountable for his actions, unless we suppose him capable of distinguishing the good from the bad; that is, unless we suppose him possessed of reason. Nor is this alone sufficient. For what would it avail him to know good from bad actions, if he had no freedom of choice, nor could avoid the one and pursue the other? hence it becomes necessary to take in both considerations in the present case. It is at the same time equally apparent, that

wherever there is this ability of distinguishing good from bad actions, and of pursuing the one and avoiding the other, there also a creature is accountable. We have then got a third idea, with which *accountableness* is inseparably connected, viz. *reason and liberty*; which are here to be considered as making up one complex conception. Let us now take this middle idea, and compare it with the other term in the question, viz. *man*, and we all know by experience that it may be affirmed of him. Having thus by means of the intermediate idea formed two several judgments, viz. *that man is possessed of reason and liberty*; and *that reason and liberty imply accountableness*; a third obviously and necessarily follows, viz. *that man is accountable for his actions*. Here then we have a complete act of reasoning, in which, according to what has been already observed, there are three distinct judgments; two that may be styled previous, inasmuch as they lead to the other, and arise from comparing the middle idea with the two ideas in the question: the third is a consequence of these previous acts, and flows from combining the extreme ideas between themselves. If now we put this reasoning into words, it exhibits what logicians term a syllogism; and, when proposed in due form, runs thus:

“Every creature possessed of reason and liberty is accountable for his actions.”

“Man is a creature possessed of reason and liberty: Therefore man is accountable for his actions.”

V. In this syllogism we may observe, that there are ⁶³ Premises, three several propositions expressing the three judgments implied in the act of reasoning; and so disposed, as to represent distinctly what passes within the mind in tracing the more distant relations of its ideas. The two first propositions answer the two previous judgments in reasoning, and are called the *premises*, because they are placed before the other. The third is termed the *conclusion*, as being gained in consequence of what was asserted in the premises. We are also to remember, that the terms expressing the two ideas whose relations we enquire after, as here *man* and *accountableness*, are in general called the *extremes*; and that the intermediate idea, by means of which the relation is traced, viz. *a creature possessed of reason and liberty*, takes the name of the *middle term*. Hence it follows, that by the *premises* of a syllogism we are always to understand the two propositions where the middle term is severally compared with the *extremes*; for these constitute the previous judgments, whence the truth we are in quest of is by reasoning deduced. The *conclusion* is that other proposition, in which the *extremes* themselves are joined or separated agreeably to what appears upon the above comparison.

VI. The conclusion is made up of the extreme terms ⁶⁴ Major and of the syllogism: and the extreme, which serves as the minor predicate of the conclusion, goes by the name of the *minor term*; the other extreme, which makes the subject in the same proposition, is called the *minor term*. From this distinction of the extremes arises also a distinction between the premises, where these extremes are severally compared with the middle term. That proposition which compares the greater extreme, or the predicate of the conclusion, with the middle term, is called the *major proposition*: the other, wherein the same middle term is compared with the subject of the *conclusion*.

conclusion or lesser extreme, is called the *minor proposition*. All this is obvious from the syllogism already given, where the conclusion is, *Man is accountable for his actions*. For here the predicate *accountable for his actions*, being connected with the middle term in the first of the two premises, *every creature possessed of reason and liberty is accountable for his actions*, gives what we call the *major proposition*. In the second of the premises, *man is a creature possessed of reason and liberty*, we find the lesser extreme, or subject of the conclusion, viz. *man*, connected with the same middle term, whence it is known to be the *minor proposition*. When a syllogism is proposed in due form, the major proposition is always' placed first, the minor next, and the conclusion last.

65
In a single act of reasoning the premises must be intuitive truths.

VII. These things premised, we may in the general define reasoning to be an act or operation of the mind, deducing some unknown proposition from other previous ones that are evident and known. These previous propositions, in a simple act of reasoning, are only two in number; and it is always required that they be of themselves apparent to the understanding, inasmuch that we assent to and perceive the truth of them as soon as proposed. In the syllogism given above, the premises are supposed to be self-evident truths; otherwise the conclusion could not be inferred by a single act of reasoning. If, for instance, in the major, *every creature possessed of reason and liberty is accountable for his actions*, the connection between the subject and predicate could not be perceived by a bare attention to the ideas themselves; it is evident that this proposition would no less require a proof than the conclusion deduced from it. In this case a new middle term must be sought for, to trace the connection here supposed; and this of course furnishes another syllogism, by which having established the proposition in question, we are then, and not before, at liberty to use it in any succeeding train of reasoning. And should it so happen, that in this second essay there was still some previous proposition whose truth did not appear at first sight, we must then have recourse to a third syllogism, in order to lay open that truth to the mind: because so long as the premises remain uncertain, the conclusion built upon them must be so too. When, by conducting our thoughts in this manner, we at last arrive at some syllogism where the previous propositions are intuitive truths; the mind then rests in full security, as perceiving that the several conclusions it has passed through stand upon the immovable foundation of self-evidence, and when traced to their source terminate in it.

66
Reasoning, in the highest exercise of it, only a concatenation of syllogisms.

VIII. We see, therefore, that in order to infer a conclusion by a single act of reasoning, the premises must be intuitive propositions. Where they are not, previous syllogisms are required; in which case reasoning becomes a complicated act, taking in a variety of successive steps. This frequently happens in tracing the more remote relation of our ideas; where, many middle terms being called in, the conclusion cannot be made out but in consequence of a series of syllogisms following one another in train. But although in this concatenation of propositions, those that form the premises of the last syllogism are often considerably removed from self-evidence; yet if we trace the reasoning backwards, we shall find them the conclusions

of previous syllogisms, whose premises approach nearer and nearer to intuition in proportion as we advance, and are found at last to terminate in it. And if, after having thus unravelled a demonstration, we take it the contrary way; and observe how the mind, setting out with intuitive perceptions, couples them together to form a conclusion; how, by introducing this conclusion into another syllogism, it still advances one step farther; and so proceeds, making every new discovery subservient to its future progress; we shall then perceive clearly, that reasoning, in the highest sense of that faculty, is no more than an orderly combination of those simple acts which we have already so fully explained.

IX. Thus we see, that reasoning, beginning with first principles, rises gradually from one judgement to another, and connects them in such manner, that every stage of the progression brings intuitive certainty along of the progression. And now at length we may clearly understand the definition given above of this distinguishing faculty of the human mind. Reason, we have said, is the ability of deducing unknown truths from principles or propositions that are already known. This evidently appears by the foregoing account, where we see that no proposition is admitted into a syllogism, to serve as one of the previous judgments on which the conclusion rests, unless it is itself a known and established truth, whose connection with self-evident principles has been already traced.

67
Requires intuitive certainty in every step of the progression.

CHAP. II. Of the several kinds of Reasoning; and first, of that by which we determine the Genera and Species of Things.

I. ALL the aims of human reason may in the general be reduced to these two: 1. To rank things under those universal ideas to which they truly belong; and, 2. To ascribe to them their several attributes and properties in consequence of that distribution.

69
Reasoning twofold.

II. One great aim of human reason is to determine the genera and species of things. We have seen in the First Part of this treatise, how the mind proceeds in framing general ideas. We have also seen in the Second Part, how by means of these general ideas we come by universal propositions. Now as in these universal propositions we affirm some property of a genus or species, it is plain that we cannot apply this property to particular objects till we have first determined whether they are comprehended under that general idea of which the property is affirmed. Thus there are certain properties belonging to all even numbers, which nevertheless cannot be applied to any particular number, until we have first discovered it to be of the species expressed by that natural name. Hence reasoning begins with referring things to their several divisions and classes in the scale of our ideas; and as these divisions are all distinguished by particular names, we hereby learn to apply the terms expressing general conceptions to such particular objects as come under our immediate observation.

69
The first kind regards the genera and species of things.
† See Foot-note, p. 195.

III. Now, in order to arrive at these conclusions, by which the several objects of perception are brought under general names, two things are manifestly necessary. First, that we take a view of the idea itself denoted by that general name, and carefully attend to

70
the steps by which we arrive at conclusions of this sort.

the distinguishing marks which serve to characterize it. Secondly, that we compare this idea with the object under consideration, observing diligently whether they agree or differ. If the idea is found to correspond with the particular object, we then without hesitation apply the general name; but if no such correspondence intervenes, the conclusion must necessarily take a contrary turn. Let us, for instance, take the number *eight*, and consider by what steps we are led to pronounce it an *even* number. First then, we call to mind the idea signified by the expression *an even number*, viz. that it is a number divisible into two equal parts. We then compare this idea with the number *eight*, and finding them manifestly to agree, see at once the necessity of admitting the conclusion. These several judgments therefore transferred into language, and reduced to the form of a syllogism, appear thus:

“Every number that may be divided into two equal parts is an *even* number:

“The number *eight* may be divided into two equal parts;

“Therefore the number *eight* is an *even* number.”

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Those steps
always fol-
lowed, tho'
in familiar
cases we do
not always
attend to
them.

IV. Here it may be observed, that where the general idea, to which particular objects are referred, is very familiar to the mind, and frequently in view; this reference, and the application of the general name, seem to be made without any apparatus of reasoning. When we see a horse in the fields, or a dog in the street, we readily apply the name of the species; habit, and a familiar acquaintance with the general idea, suggesting it instantaneously to the mind. We are not however to imagine on this account that the understanding departs from the usual rules of just thinking. A frequent repetition of acts begets a habit; and habits are attended with a certain promptness of execution, that prevents our observing the several steps and gradations by which any course of action is accomplished. But in other instances, where we judge not by precontracted habits, as when the general idea is very complex, or less familiar to the mind, we always proceed according to the form of reasoning established above. A goldsmith, for instance, who is in doubt as to any piece of metal, whether it be of the species called *gold*, first examines its properties, and then comparing them with the general idea signified by that name, if he finds a perfect correspondence, no longer hesitates under what class of metals to rank it.

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The great
importance
of this
branch of
reasoning.

V. Nor let it be imagined that our researches here, because in appearance bounded to the imposing of general names upon particular objects, are therefore trivial and of little consequence. Some of the most considerable debates among mankind, and such too as nearly regard their lives, interest, and happiness, turn wholly upon this article. Is it not the chief employment of our several courts of judicature to determine in particular instances, what is law, justice, and equity? Of what importance is it in many cases to decide a-right whether an action shall be termed *murder* or *manslaughter*? We see then that no less than the lives and fortunes of men depend often upon these decisions. The reason is plain. Actions, when once referred to a general idea, draw after them all that may be affirmed of that idea; inasmuch that the determining the species of actions is all one with determining what

proportion of praise or dispraise, commendation or blame, &c. ought to follow them. For as it is allowed that murder deserves death; by bringing any particular action under the head of murder, we of course decide the punishment due to it.

VI. But the great importance of this branch of reason-⁷³ing, and the necessity of care and circumspection And the ex-act obser- in referring particular objects to general ideas, is still vance of it farther evident from the practice of the mathematicians. Every one who has read Euclid knows, that he frequently requires us to draw lines through certain points, and according to such and such directions. The figures thence resulting are often squares, parallelograms, or rectangles. Yet Euclid never supposes this from their bare appearance, but always demonstrates it upon the strictest principles of geometry. Nor is the method he takes in any thing different from that described above. Thus, for instance, having defined a square to be a figure bounded by four equal sides joined together at right angles; when such a figure arises in any construction previous to the demonstration of a proposition, yet he never calls it by that name until he has shown that its sides are equal, and all its angles right ones. Now this is apparently the same form of reasoning we have before exhibited in proving *eight* to be an even number.

VII. Having thus explained the rules by which we⁷⁴ are to conduct ourselves in ranking particular objects Fixed and invariable under general ideas, and shown their conformity to ideas, with the practice and manner of the mathematicians; it remains only to observe, that the true way of rendering this part of knowledge both easy and certain, is, by habituating ourselves to clear and determinate ideas, and keeping them steadily annexed to their respective names. For as all our aim is to apply general words aright, if these words stand for invariable ideas that are perfectly known to the mind, and can be readily distinguished upon occasion, there will be little danger of mistake or error in our reasonings. Let us suppose that, by examining any object, and carrying our attention successively from one part to another, we have acquainted ourselves with the several particulars observable in it. If among these we find such as constitute some general idea, framed and settled beforehand by the understanding, and distinguished by a particular name, the resemblance thus known and perceived necessarily determines the species of the object, and thereby gives it a right to the name by which that species is called. Thus four equal sides, joined together at right angles, make up the notion of a *square*. As this is a fixed and invariable idea, without which the general name cannot be applied; we never call any particular figure a *square* until it appears to have these several conditions; and contrarily, wherever a figure is found with these conditions, it necessarily takes the name of a *square*. The same will be found to hold in all our other reasonings of this kind, where nothing can create any difficulty but the want of settled ideas. If, for instance, we have not determined within ourselves the precise notion denoted by the word *manslaughter*, it will be impossible for us to decide whether any particular action ought to bear that name: because, however nicely we examine the action itself, yet, being strangers to the general idea with which it is to be compared, we are utterly unable

unable to judge of their agreement or disagreement. But if we take care to remove this obstacle, and distinctly trace the two ideas under consideration, all difficulties vanish, and the resolution becomes both easy and certain.

VIII. Thus we see of what importance it is towards the improvement and certainty of human knowledge, that we accustom ourselves to clear and determinate ideas, and a steady application of words.

CHAP. III. Of Reasoning, as it regards the Powers and Properties of Things, and the Relations of our general Ideas.

⁷⁵ The distinction of reasoning, as it regards the sciences and as it concerns common life.

I. WE now come to the second great end which men have in view in their reasonings; namely, the discovering and ascribing to things their several attributes and properties. And here it will be necessary to distinguish between reasoning, as it regards the sciences, and as it concerns common life. In the sciences, our reason is employed chiefly about universal truths, it being by them alone that the bounds of human knowledge are enlarged. Hence the division of things into various classes, called otherwise *genera* and *species*. For these universal ideas being set up as the representatives of many particular things, whatever is affirmed of them may be also affirmed of all the individuals to which they belong. *Murder*, for instance, is a general idea, representing a certain species of human actions. Reason tells us that the punishment due to it is *death*. Hence every particular action, coming under the notion of *murder*, has the punishment of *death* allotted to it. Here then we apply the general truth to some obvious instance; and this is what properly constitutes the reasoning of common life. For men, in their ordinary transactions and intercourse one with another, have, for the most part, to do only with particular objects. Our friends and relations, their characters and behaviour, the constitution of the several bodies that surround us, and the uses to which they may be applied, are what chiefly engage our attention. In all these, we reason about particular things; and the whole result of our reasoning is, the applying the general truths of the sciences in the ordinary transactions of human life. When we see a viper, we avoid it. Wherever we have occasion for the forcible action of water to move a body that makes considerable resistance, we take care to convey it in such a manner that it shall fall upon the object with impetuosity. Now all this happens in consequence of our familiar and ready application of these two general truths. *The bite of a viper is mortal. Water, falling upon a body with impetuosity, acts very forcibly towards setting it in motion.* In like manner, if we set ourselves to consider any particular character, in order to determine the share of praise or dispraise that belongs to it, our great concern is to ascertain exactly the proportion of virtue and vice. The reason is obvious. A just determination, in all cases of this kind, depends entirely upon an application of these general maxims of morality: *Virtuous actions deserve praise; vicious actions deserve blame.*

II. Hence it appears that reasoning, as it regards common life, is no more than the ascribing the general properties of things to those several objects which

which we are more immediately concerned, according as they are found to be of that particular division or class to which the properties belong. The steps then by which we proceed are manifestly these. First, in the reasoning we refer the object under consideration to some general idea or class of things. We then recollect the several attributes of that general idea. And, lastly, ascribe all those attributes to the present object. Thus, in considering the character of *Sempronius*, if we find it to be of the kind called *virtuous*, when we at the same time reflect that a virtuous character is deserving of esteem, it naturally and obviously follows that *Sempronius* is so too. These thoughts put into a *syllogism*, in order to exhibit the form of reasoning here required, run thus:

"Every virtuous man is worthy of esteem.

"*Sempronius* is a virtuous man:

"Therefore *Sempronius* is worthy of esteem."

III. By this *syllogism* it appears, that before we affirm any thing of a particular object, that object must be referred to some general idea. *Sempronius* is pronounced worthy of esteem only in consequence of his being a virtuous man, or coming under that general character of reason. Hence we see the necessary connection of the various parts of reasoning, and the dependence they have one upon another. The determining the genera and species of things is, as we have said, one exercise of human reason; and here we find that this exercise is the first in order, and previous to the other, which consists in ascribing to them their powers, properties, and relations. But when we have taken this previous step, and brought particular objects under general names; as the properties we ascribe to them are no other than those of the general idea, it is plain that, in order to a successful progress in this part of knowledge, we must thoroughly acquaint ourselves with the several relations and attributes of these our general ideas. When this is done, the other part will be easy, and requires scarce any labour or thought, as being no more than an application of the general form of reasoning represented in the foregoing *syllogism*. Now, as we have already sufficiently shown how we are to proceed in determining the genera and species of things, which, as we have said, is the previous step to this second branch of human knowledge; all that is farther wanting towards a due explanation of it is, to offer some considerations as to the manner of investigating the general relations of our ideas. This is the highest exercise of the powers of the understanding, and that by means whereof we arrive at the discovery of universal truths; inasmuch that our deductions in this way constitute that particular species of reasoning which we have before said regards principally the sciences.

IV. But that we may conduct our thoughts with some order and method, we shall begin with observing, that the relations of our general ideas are of two kinds: either such as immediately discover themselves, upon comparing the ideas one with another; or such as, being more remote and distant, require art and contrivance to bring them into view. The relations of the first kind furnish us with intuitive and self-evident truths: those of the second are traced by reasoning, and a due application of intermediate ideas. It is of this last kind that we are to speak here, having

⁷⁶ The steps by which we proceed in the reasoning of common life.

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⁷⁸ Two things required to make a good reasoner.

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dispatched what was necessary with regard to the other in the Second Part. As, therefore, in tracing the more distant relations of things, we must always have recourse to intervening ideas, and are more or less successful in our researches according to our acquaintance with these ideas, and ability of applying them; it is evident that, to make a good reasoner, two things are principally required. *First*, An extensive knowledge of those intermediate ideas, by means of which things may be compared one with another. *Secondly*, The skill and talent of applying them happily in all particular instances that come under consideration.

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First, an
extensive
knowledge
of interme-
diate ideas.

V. In order to our successful progress in reasoning, we must have an extensive knowledge of those intermediate ideas by means of which things may be compared one with another. For as it is not every idea that will answer the purpose of our inquiries, but such only as are peculiarly related to the objects about which we reason, so as, by a comparison with them, to furnish evident and known truths; nothing is more apparent than that the greater variety of conceptions we can call into view, the more likely we are to find some among them that will help us to the truths here required. And, indeed, it is found to hold in experience, that in proportion as we enlarge our views of things, and grow acquainted with a multitude of different objects, the reasoning faculty gathers strength: for, by extending our sphere of knowledge, the mind acquires a certain force and penetration, as being accustomed to examine the several appearances of its ideas, and observe what light they cast one upon another.

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To excel
in any one
branch of
learning,
we must be
in general
acquainted
with the
whole circle
of arts and
sciences.

VI. This is the reason why, in order to excel remarkably in any one branch of learning, it is necessary to have at least a general acquaintance with the whole circle of arts and sciences. The truth of it is, all the various divisions of human knowledge are very nearly related among themselves, and, in innumerable instances, serve to illustrate and set off each other. And although it is not to be denied that, by an obstinate application to one branch of study, a man may make considerable progress, and acquire some degree of eminence in it; yet his views will be always narrow and contracted, and he will want that masterly discernment which not only enables us to pursue our discoveries with ease, but also, in laying them open to others, to spread a certain brightness around them. But when our reasoning regards a particular science, it is farther necessary that we more nearly acquaint ourselves with whatever relates to that science. A general knowledge is a good preparation, and enables us to proceed with ease and expedition in whatever branch of learning we apply to. But then, in the minute and intricate questions of any science, we are by no means qualified to reason with advantage until we have perfectly mastered the science to which they belong.

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Secondly,
the skill of
applying in-
termediate
ideas hap-
pily in par-
ticular in-
stances.

VII. We come now to the second thing required, in order to a successful progress in reasoning; namely, the skill and talent of applying intermediate ideas happily in all particular instances that come under consideration. And here, rules and precepts are of little service. Use and experience are the best instructors. For, whatever logicians may boast of

Nº 186.

being able to form perfect reasoners by book and rule, we find by experience, that the study of their precepts does not always add any great degree of strength to the understanding. In short, it is the habit alone of reasoning that makes a reasoner. And therefore the true way to acquire this talent is, by being much conversant in those sciences where the art of reasoning is allowed to reign in the greatest perfection. Hence it was that the ancients, who so well understood the manner of forming the mind, always began with *mathematics*, as the foundation of their philosophical studies. Here the understanding is by degrees habituated to truth, contracts insensibly a certain fondness for it, and learns never to yield its assent to any proposition but where the evidence is sufficient to produce full conviction. For this reason *Plato* has called mathematical demonstrations the *cathartics* or purgatives of the soul, as being the proper means to cleanse it from error, and restore that natural exercise of its faculties in which just thinking consists.

VIII. If therefore we would form our minds to the habit of reasoning closely and in train, we cannot take any more certain method than the exercising ourselves in mathematical demonstrations, so as to contract a kind of familiarity with them. Not that we look upon it as necessary that all men should be deep mathematicians; but that, having got the way of reasoning which that study necessarily brings the mind to, they may be able to transfer it to other parts of knowledge, as they shall have occasion.

IX. But although the study of mathematics be of all others the most useful to form the mind and give it such an early relish of truth, yet ought not other parts of philosophy to be neglected. For there also we meet with many opportunities of exercising the powers of the understanding; and the variety of subjects naturally leads us to observe all those different turns of thinking that are peculiarly adapted to the several ideas we examine, and the truth we search after. A mind thus trained acquires a certain mastery over its own thoughts, inasmuch that it can range and model them at pleasure, and call such into view as best suit its present designs. Now in this the whole art of reasoning consists; from among a great variety of different ideas to single out those that are most proper for the business in hand, and to lay them together in such order, that from plain and easy beginnings, by gentle degrees, and a continued train of evident truths, we may be insensibly led on to such discoveries, as at our first setting out appeared beyond the reach of human understanding. For this purpose, besides the study of mathematics before recommended, we ought to apply ourselves diligently to the reading of such authors as have distinguished themselves for strength of reasoning, and a just and accurate manner of thinking. For it is observable, that a mind exercised and seasoned to truth, seldom rests satisfied in a bare contemplation of the arguments offered by others; but will be frequently assaying its own strength, and pursuing its discoveries upon the plan it is most accustomed to. Thus we insensibly contract a habit of tracing truth from one stage to another, and of investigating those general relations and properties which we afterwards ascribe to particular things, according as we find them compre-

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hended under the abstract ideas to which the properties belong.

CHAP. IV. Of the Forms of Syllogisms.

64
The figures
of syllogisms.

I. HITHERTO we have contented ourselves with a general notion of syllogisms, and of the parts of which they consist. It is now time to enter a little more particularly into the subject, to examine their various forms, and lay open the rules of argumentation proper to each. In the syllogisms mentioned in the foregoing chapters, we may observe, that the *middle term* is the subject of the *major* proposition, and the predicate of the *minor*. This disposition, though the most natural and obvious, is not however necessary; it frequently happening, that the middle term is the subject in both the premises, or the predicate in both; and sometimes, directly contrary to its disposition in the foregoing chapters, the predicate in the major, and the subject in the minor. Hence the distinction of syllogisms into various kinds, called *figures* by logicians. For figure, according to their use of the word, is nothing else but the order and disposition of the middle term in any syllogism. And as this disposition is, we see, fourfold, so the figures of syllogisms thence arising are four in number. When the middle term is the subject of the major proposition, and the predicate of the minor, we have what is called the *first figure*: As,

"No work of God is bad:

"The natural passions and appetites of men are

"the work of God:

"Therefore none of them is bad."

If, on the other hand, it is the predicate of both the premises, the syllogism is said to be the *second figure*: As,

"Whatever is bad is not the work of God:

"All the natural passions and appetites of men

"are the work of God:

"Therefore the natural passions and appetites of

"men are not bad."

Again, in the *third figure*, the middle term is the subject of the two premises: As,

"All Africans are black:

"All Africans are men:

"Therefore some men are black."

And lastly, by making it the predicate of the major, and subject of the minor, we obtain syllogisms in the *fourth figure*: As,

"The only being who ought to be worshipped is

"the Creator and Governor of the world:

"The Creator and Governor of the world is

"God:

"Therefore God is the only being who ought to be worshipped."

85
The moods
of syllogisms.

II. But, besides this fourfold distinction of syllogisms, there is also a farther subdivision of them in every figure, arising from the *quantity* and *quality*, as they are called, of the propositions. By quantity we mean the consideration of propositions, as universal or particular; by quality, as affirmative or negative.

Now as, in all the several dispositions of the middle term, the propositions of which a syllogism consists may be either universal or particular, affirmative or

negative; the due determination of these, and so putting them together as the laws of argumentation require, constitute what logicians call the *moods* of syllogisms. Of these moods there is a determinate number to every figure, including all the possible ways in which propositions differing in quantity or quality can be combined, according to any disposition of the middle term, in order to arrive at a just conclusion.

The first figure has only four legitimate moods. The major proposition in this figure must be universal, and the minor affirmative; and it has this property, that it yields conclusions of all kinds, affirmative and negative, universal and particular.

The second figure has also four legitimate moods. Its major proposition must be universal, and one of the premises must be negative. It yields conclusions both universal and particular, but all negative.

The third figure has six legitimate moods. Its minor must always be affirmative; and it yields conclusions both affirmative and negative, but all particular. — These are all the figures which were admitted by the inventor of syllogisms; and of which, so far as we know, the number of legitimate moods has been ascertained, and severally demonstrated. In every figure it will be found upon trial, that there are *sixty-four* different moods of syllogism; and he who thinks it worth while to construct so many in the *fourth figure*, always remembering that the middle term in each must be the predicate of the major and the subject of the minor proposition, will easily discern what number of these moods are legitimate; and give true conclusions.

Besides the rules that are proper to each figure, Aristotle has given some that are common to all, by which the legitimacy of syllogisms may be tried. These may be reduced to five: — 1. There must be only *three terms* in a syllogism: As each term occurs in two of the propositions, it must be precisely the *same in both*; if it be not, the syllogism is said to have *four terms*, which makes a *vicious* syllogism. 2. The middle term must be taken *universally* in one of the premises. 3. Both premises must *not* be *particular* propositions, nor both *negative*. 4. The conclusion must be *particular*, if either of the premises be *particular*; and *negative*, if either of the premises be *negative*. 5. No term can be taken *universally* in the conclusion, if it be not taken *universally* in the premises.

For understanding the *second* and *third* of these rules, it is necessary to observe, that a term is said to be taken *universally*, not only when it is the *subject* of a universal proposition, but also when it is the *predicate* of a negative proposition. On the other hand, a term is said to be taken *particularly*, when it is either the *subject* of a particular or the *predicate* of an affirmative proposition.

III. The division of syllogisms according to mood and figure respects those especially which are known of the other by the name of plain simple syllogisms; that is, which are bounded to three propositions, all simple, and where the extremes and middle term are connected, according to the rules laid down above. But as the mind is not tied down to any one precise form of reasoning, but sometimes makes use of more, sometimes of fewer premises, and often takes in compound and conditional propositions, it may not be amiss to take

notice of the different forms derived from this source, and explain the rules by which the mind conducts itself in the use of them.

87
Conditionals.
sylogisms. IV. When in any syllogism the major is a conditional proposition, the syllogism itself is termed *conditional*. Thus:

"If there is a God, he ought to be worshipped:

"But there is a God:

"Therefore he ought to be worshipped."

In this example, the major, or first proposition, is, we see, conditional, and therefore the syllogism itself is also of the kind called by that name. And here we are to observe, that all conditional propositions are made of two distinct parts: one expressing the condition upon which the predicate agrees or disagrees with the subject, as in this now before us, *if there is a God*; the other joining or disjoining the said predicate and subject, as here, *he ought to be worshipped*. The first of these parts, or that which implies the condition, is called the *antecedent*; the second, where we join or disjoin the predicate and subject, has the name of the *consequent*.

88
Ground of
inference in
conditional
sylogisms. V. In all propositions of this kind, supposing them to be exact in point of form, the relation between the antecedent and consequent must ever be true and real; that is, the antecedent must always contain some certain and genuine condition, which necessarily implies the consequent; for otherwise the proposition itself will be false, and therefore ought not to be admitted into our reasonings. Hence it follows, that when any conditional proposition is assumed, if we admit the antecedent of that proposition, we must at the same time necessarily admit the consequent; but if we reject the consequent, we are in like manner bound to reject the antecedent. For as the antecedent always expresses some condition which necessarily implies the truth of the consequent; by admitting the antecedent, we allow of that condition, and therefore ought also to admit the consequent. In like manner, if it appears that the consequent ought to be rejected, the antecedent evidently must be so too; because, as was just now demonstrated, the admitting of the antecedent would necessarily imply the admission also of the consequent.

89
The two
moods of
conditional
sylogisms. VI. There are two ways of arguing in *hypothetical* syllogisms, which lead to a certain and unavoidable conclusion. For as the major is always a conditional proposition, consisting of an antecedent and a consequent; if the minor admits the antecedent, it is plain that the conclusion must admit the consequent. This is called arguing from the admission of the antecedent to the admission of the consequent, and constitutes that mood or species of hypothetical syllogisms which is distinguished in the schools by the name of the *modus ponens*, inasmuch as by it the whole conditional proposition, both antecedent and consequent, is established. Thus:

"If God is infinitely wise, and acts with perfect freedom, he does nothing but what is best:

"But God is infinitely wise, and acts with perfect freedom:

"Therefore he does nothing but what is best."

Here we see the antecedent or first part of the conditional proposition is established in the minor, and the consequent or second part in the conclusion; whence the syllogism itself is an example of the *modus ponens*.

But if now we on the contrary suppose that the minor rejects the consequent, then it is apparent that the conclusion must also reject the antecedent. In this case we are said to argue from the removal of the consequent to the removal of the antecedent, and the particular mood or species of syllogisms thence arising is called by logicians the *modus tollens*; because in it both antecedent and consequent are rejected or taken away, as appears by the following example.

"If God were not a Being of infinite goodness,

"neither would he consult the happiness of his creatures:

"But God does consult the happiness of his creatures:

"Therefore he is a being of infinite goodness.

VII. These two species take in the whole class of ⁹⁰They include all the legitimate ways of arguing. conditional syllogisms, and include all the possible ways of arguing that lead to a legitimate conclusion; because we cannot here proceed by a contrary process of reasoning, that is, from the removal of the antecedent to the removal of the consequent, or from the establishing of the consequent to the establishing of the antecedent. For although the antecedent always expresses some real condition, which, once admitted, necessarily implies the consequent, yet it does not follow that there is therefore no other condition; and if so, then, after removing the antecedent, the consequent may still hold, because of some other determination that infers it. When we say, *If a stone is exposed some time to the rays of the sun, it will contract a certain degree of heat*; the proposition is certainly true; and, admitting the antecedent, we must also admit the consequent. But as there are other ways by which a stone may gather heat, it will not follow, from the ceasing of the before-mentioned condition, that therefore the consequent cannot take place. In other words, we cannot argue: *But the stone has not been exposed to the rays of the sun; therefore neither has it any degree of heat*: Inasmuch as there are a great many other ways by which heat might have been communicated to it. And if we cannot argue from the removal of the antecedent to the removal of the consequent, no more can we from the admission of the consequent to the admission of the antecedent; because, as the consequent may flow from a great variety of different suppositions, the allowing of it does not determine the precise supposition, but only that some one of them must take place. Thus in the foregoing proposition, *If a stone is exposed some time to the rays of the sun, it will contract a certain degree of heat*; admitting the consequent, viz. *that it has contracted a certain degree of heat*, we are not therefore bound to admit the antecedent, *that it has been some time exposed to the rays of the sun*; because there are many other causes whence that heat may have proceeded. These two ways of arguing, therefore, hold not in conditional syllogisms.

VIII. As from the major's being a conditional ⁹¹The manner of arguing in disjunctive syllogisms. proposition, we obtain the species of conditional syllogisms; so, where it is a disjunctive proposition, the syllogism to which it belongs is also called *disjunctive*, as in the following example:

"The world is either self-existent, or the work of some finite, or of some infinite Being:

"But

"But it is not self-existent, nor the work of a finite being :

"Therefore it is the work of an infinite Being."

Now, a disjunctive proposition is that, where of several predicates, we affirm one necessarily to belong to the subject, to the exclusion of all the rest, but leave that particular one undetermined. Hence it follows, that as soon as we determine the particular predicate, all the rest are of course to be rejected ; or if we reject all the predicates but one, that one necessarily takes place. When, therefore, in a disjunctive syllogism, the several predicates are enumerated in the major ; if the minor establishes any one of these predicates, the conclusion ought to remove all the rest ; or if, in the minor, all the predicates but one are removed, the conclusion must necessarily establish that one. Thus, in the disjunctive syllogism given above, the major affirms one of the three predicates to belong to the earth, *viz. self-existence, or that it is the work of a finite, or that it is the work of an infinite Being.* Two of these predicates are removed in the minor, *viz. self-existence, and the work of a finite being.* Hence the conclusion necessarily ascribes to it the third predicate, and affirms that it is *the work of an infinite Being.* If now we give the syllogism another turn, inasmuch that the minor may establish one of the predicates, by affirming the earth to be *the production of an infinite Being :* then the conclusion must remove the other two, asserting it to be neither *self-existent, nor the work of a finite being.* These are the forms of reasoning in these species of syllogisms, the justness of which appears at first sight : and that there can be no other, is evident from the very nature of a disjunctive proposition.

92
Imperfect
or mutilated
syllogisms.

IX. In the several kinds of syllogisms hitherto mentioned, we may observe, that the parts are complete ; that is, the three propositions of which they consist are represented in form. But it often happens, that some one of the premises is not only an evident truth, but also familiar and in the minds of all men ; in which case it is usually omitted, whereby we have an imperfect syllogism, that seems to be made up of only two propositions. Should we, for instance, argue in this manner :

"Every man is mortal :

"Therefore every king is mortal."

the syllogism appears to be imperfect, as consisting but of two propositions. Yet it is really complete ; only the minor [*every king is a man*] is omitted : and left to the reader to supply, as being a proposition so familiar and evident that it cannot escape him.

93
Enthymemes.

X. These seemingly imperfect syllogisms are called *enthymemes* ; and occur very frequently in reasoning, especially where it makes a part of common conversation. Nay, there is a particular elegance in them, because, not displaying the argument in all its parts, they leave somewhat to the exercise and invention of the mind. By this means we are put upon exerting ourselves, and seem to share in the discovery of what is proposed to us. Now this is the great secret of fine writing, to frame and put together our thoughts, as to give full play to the reader's imagination, and draw him insensibly into our very views and course of reasoning. This gives a pleasure not unlike to that which the author himself feels in composing. It besides

shortens discourse, and adds a certain force and liveliness to our arguments, when the words in which they are conveyed favour the natural quickness of the mind in its operations, and a single expression is left to exhibit a whole train of thoughts.

XI. But there is another species of reasoning with Ground of reasoning in immediate consequences.
two propositions, which seems to be complete in itself, and where we admit the conclusion without supposing any tacit or suppressed judgment in the mind, from which it follows syllogistically. This happens between propositions, where the connection is such, that the admission of the one necessarily and at the first sight implies the admission also of the other. For if it so falls out, that the proposition on which the other depends is self-evident, we content ourselves with barely affirming it, and infer that other by a direct conclusion. Thus, by admitting an universal proposition, we are forced also to admit of all the particular propositions comprehended under it, this being the very condition that constitutes a proposition universal. If then that universal proposition chances to be self-evident, the particular ones follow of course, without any farther train of reasoning. Whoever allows, for instance, *that things equal to one and the same thing are equal to one another*, must at the same time allow, *that two triangles, each equal to a square whose side is three inches, are also equal between themselves.* This argument therefore,

"Things equal to one and the same thing, are equal

"to one another :

"Therefore these two triangles, each equal to the

"square of a line of three inches, are equal between themselves."

is complete in its kind, and contains all that is necessary towards a just and legitimate conclusion. For the first or universal proposition is self-evident, and therefore requires no farther proof. And as the truth of the particular is inseparably connected with that of the universal, it follows from it by an obvious and unavoidable consequence.

XII. Now, in all cases of this kind, where propositions are deduced one from another, on account of a known and evident connection, we are said to reason by immediate consequence. Such a coherence of propositions manifest at first sight, and forcing itself upon the mind, frequently occurs in reasoning. Logicians have explained at some length the several suppositions upon which it takes place, and allow of all immediate consequences that follow in conformity to them. It is however observable, that these arguments, though seemingly complete, because the conclusion follows necessarily from the single proposition that goes before, may yet be considered as real enthymemes, whose major, which is a conditional proposition, is wanting. The syllogism but just mentioned, when represented according to this view, will run as follows :

"If things equal to one and the same thing, are equal to one another ; these two triangles, each equal to a square whose side is three inches, are also equal between themselves.

"But things equal to one and the same thing, are equal to one another :

"Therefore also these triangles, &c. are equal between themselves."

This observation will be found to hold in all immediate

direct consequences whatsoever, inasmuch that they are in fact no more than enthymemes of hypothetical syllogisms. But then it is particular to them, that the ground on which the conclusion rests, namely its coherence with the minor, is of itself apparent, and seen immediately to flow from the rules and reasons of logic.

56
A series of
plain simple
syllogisms.

XIII. The next species of reasoning we shall take notice of here is what is commonly known by the name of a *series*. This is a way of arguing, in which a great number of propositions are so linked together, that the predicate of one becomes continually the subject of the next following, until at last a conclusion is formed, by bringing together the subject of the first proposition, and the predicate of the last. Of this kind is the following argument.

"God is omnipotent :

"An omnipotent being can do every thing possible :

"He that can do every thing possible, can do whatever involves not a contradiction :

"Therefore God can do whatever involves not a contradiction."

This particular combination of propositions may be continued to any length we please, without in the least weakening the ground upon which the conclusion rests. The reason is, because the series itself may be resolved into as many simple syllogisms as there are middle terms in it; where this is found universally to hold, that when such a resolution is made, and the syllogisms are placed in train, the conclusion of the last in the series is also the conclusion of the series. This kind of argument, therefore, as it serves to unite several syllogisms into one, must stand upon the same foundation with the syllogisms of which it consists, and is indeed, properly speaking, no other than a compendious way of reasoning syllogistically.

97
A series of
hypothetical
syllogisms.

XIV. What is here said of plain simple propositions may be as well applied to those that are conditional; that is, any number of them may be so joined together in a series, that the consequent of one shall become continually the antecedent of the next following; in which case, by establishing the antecedent of the first proposition, we establish the consequent of the last, or by removing the last consequent remove also the first antecedent. This way of reasoning is exemplified in the following argument.

"If we love any person, all emotions of hatred towards him cease :

"If all emotions of hatred towards a person cease, we cannot rejoice in his misfortunes :

"If we rejoice not in his misfortunes, we certainly wish him no injury :

"Therefore, if we love a person, we wish him no injury."

It is evident that this series, as well as the last, may be resolved into a series of distinct syllogisms, with this only difference, that here the syllogisms are all conditional.

98
The ground
of argu-
mentation
in a dilem-
ma.

XV. The last species of syllogism we shall take notice of in this chapter is that commonly distinguished by the name of a *dilemma*. A dilemma is an argument by which we endeavour to prove the absurdity or falsehood of some assertion. In order to this, we assume a conditional proposition, the antecedent

of which is the assertion to be disproved, and the consequent a disjunctive proposition, enumerating all the possible suppositions upon which that assertion can take place. If then it appears, that all these several suppositions ought to be rejected, it is plain, that the antecedent or assertion itself must be so too. When therefore such a proposition as that before mentioned is made the major of any syllogism; if the minor rejects all the suppositions contained in the consequent, it follows necessarily, that the conclusion ought to reject the antecedent, which, as we have said, is the very assertion to be disproved. This particular way of arguing is that which logicians call a *dilemma*; and from the account here given of it, it appears that we may in the general define it to be a hypothetical syllogism, where the consequent of the major is a disjunctive proposition, which is wholly taken away or removed in the minor. Of this kind is the following :

"If God did not create the world perfect in its

"kind, it must either proceed from want of inclination, or from want of power :

"But it could not proceed either from want of inclination, or from want of power :

"Therefore, he created the world perfect in its kind." Or, which is the same thing : "It is absurd to say that he did not create the world perfect in its kind."

XVI. The nature then of a dilemma is universally this. The major is a conditional proposition, whose consequent contains all the several suppositions upon which the antecedent can take place. As therefore these suppositions are wholly removed in the minor, it is evident that the antecedent must be so too; inasmuch that we here always argue from the removal of the consequent to the removal of the antecedent. That is, a dilemma is an argument in the *modus tollens* of hypothetical syllogisms, as logicians love to speak. Hence it is plain, that if the antecedent of the major is an affirmative proposition, the conclusion of the dilemma will be negative; but if it is a negative proposition, the conclusion will be affirmative.

CHAP. V. Of Induction.

I. ALL reasoning proceeds ultimately from first truths, either self-evident or taken for granted; and the first truths of syllogistic reasonings are general propositions. But except in the mathematics, and such other sciences as, being conversant about mere ideas, have no immediate relation to things without the mind, we cannot assume as truths propositions which are general. The mathematician indeed may be considered as taking his ideas from the beginning in their general form. Every proposition composed of such ideas is therefore general; and those which are theoretic are reducible to two parts, or terms, a predicate and a subject, with a copula generally affirmative. If the agreement or the relation between the two terms be not immediate and self-evident, he has recourse to an *axiom*, which is a proposition still more general, and which supplies him with a third or middle term. This he compares first with the predicate, and then with the subject, or vice versa. These two comparisons, when drawn out in form, make two propositions,

positions, which are called the *premises*; and if they happen to be *immediate* and *self-evident*, the *conclusion*, consisting of the terms of the question proposed, is said to be demonstrated. This method of reasoning is conducted exactly in the syllogistic form explained in the preceding chapter.

II. But in sciences which treat of things external to the mind, we cannot assume as *first principles* the most general propositions, and from them infer others less and less general till we descend to particulars. The reason is obvious. Every thing in the universe, whether of mind or body, presents itself to our observation in its individual state; so that *perception* and *judgment* employed in the investigation of truth, whether *physical*, *metaphysical*, *moral*, or *historical*, have in the first place to encounter with *PARTICULARS*. "With these reason begins, or should begin, its operations. It observes, tries, canvasses, examines, and compares them together, and judges of them by some of those native evidences and original lights which, as they are the first and indispensable inlets of knowledge to the mind, have been called the *primary principles of truth*. See *METAPHYSICS*.

101
From which, by induction, it ascends to generals or axioms.

III. "By such acts of observation and judgment, diligently practised and frequently repeated, on many *instances* of the same class or of a similar nature, noting their agreements, marking their differences however minute, and rejecting all instances which, however similar in appearance, are not in effect the same, *REASON*, with much labour and attention, extracts some *general laws* respecting the powers, properties, qualities, actions, passions, virtues, and relations of *real things*. This is no hasty, premature, *notional* abstraction of the mind, by which images and ideas are formed that have no archetypes in nature: it is a rational, operative, experimental process, instituted and executed upon the constitution of beings, which in part compose the universe. By this process *REASON* advances from *particulars* to *generals*, from *less general* to *more general*, till by a series of flow progression, and by regular degrees, it arrive at the *most general* notions, called *FORMS* or *FORMAL CAUSES* (c). And by *affirming* or *denying* a genus of a species, or an accident of a substance or class of substances, through all the stages of the gradation, we form

conclusions, which, if logically drawn, are *AXIOMS* (d) or general propositions ranged one above another, till they terminate in those that are *UNIVERSAL*.

102

IV. "Thus, for instance, the *evidence of the external senses* is obviously the *PRIMARY PRINCIPLE* from which all physical knowledge is derived. But, whereas nature begins with *causes*, which, after a variety of changes, produce *effects*, the senses open upon the *effects*, and from them, through the slow and painful road of experiment and observation, ascend to *causes*. By experiments and observations skillfully chosen, artfully conducted, and judiciously applied, the philosopher advances from one stage of inquiry to another in the rational investigation of the general *causes* of physical truth. From different experiments and observations made on the same individual subject, and from the same experiments and observations made on different subjects of the same kind, by comparing and judging, he discovers some *qualities*, *causes*, or *phenomena*, which, after carefully distinguishing and rejecting all contradictory instances that occur, he finds common to many. Thus, from many collateral comparisons and judgments formed upon *particulars*, he ascends to *generals*; and by a repetition of the same industrious process and laborious investigation, he advances from *general* to *more general*, till at last he is enabled to form a few of the *most general*, with their attributes and operations, into *AXIOMS* or *secondary principles*, which are the well-founded laws enacted and enforced by the God of nature.—This is that just and philosophic method of reasoning which sound logic precribes in this as well as in other parts of learning; by which, through the slow but certain road of experiment and observation, the mind ascends from appearances to qualities, from effects to causes, and from experiments upon many particular subjects forms *general propositions* concerning the powers and properties of physical body.

103

V. "AXIOMS so investigated and established are applicable to all parts of learning, and are the indispensable, and indeed the wonderful expedients, by which, in every branch of knowledge, reason pushes on its inquiries in the particular pursuit of truth: and the method of reasoning by which they are formed, is that of true and legitimate *INDUCTION*; which is therefore by

Lord

AXIOMS, so established, applicable in all parts of learning.

(c) Qui FORMAS novit, is, quæ adhuc non facta sunt, qualia nec naturæ vicissitudines, nec experimentales induitrix unquam in ætuum produxissent, nec cogitationem humanam subituræ fuissent, detegit et educit. *Baconi Nov. Org.*

(d) The word axiom ἀξίωμα literally signifies *dignity*: Hence it is used metaphorically to denote a *general truth* or *maxim*, and sometimes any truth that is *self-evident*, which is called a *dignity* on account of its importance in a process of reasoning. The axioms of Euclid are propositions extremely general; and so are the axioms of the Newtonian philosophy. But these two kinds of axioms have very different origins. The former appear true upon a bare contemplation of our ideas; whereas the latter are the result of the most laborious induction. Lord Bacon therefore strenuously contends that they should never be taken upon conjecture, or even upon the authority of the learned; but that, as they are the general principles and grounds of all learning, they should be canvassed and examined with the most scrupulous attention, "ut axiomatum corrigatur iniquitas, quæ plerumque in exemplis vulgaris fundamentum habent:" *De Augm. Sc.* lib. ii. cap. 2. "Atque illa ipsa putativa principia ad rationes reddendas compellere decrevimus, quousque plane constaret." *Distrib. Operis*.—Dr Tatnam makes a distinction between axioms *intuitive* and axioms *self-evident*. *Intuitive axioms*, according to him, pass through the first inlets of knowledge, and flash direct conviction on the minds, as external objects do on the senses, of all men. Other axioms, though not intuitive, may be properly said to be *self-evident*; because, in their formation, reason judges by single comparisons without the help of a third idea or middle term; so that they have their evidence in themselves, and though inductively framed they cannot be syllogistically proved. Is this distinction be just, and we think it is; only *particular truths* can be intuitive axioms.

Lord Bacon, the best and foundest of logicians, called the *key of interpretation*.

VI. "Instead of taking his axioms arbitrarily out of the great families of the categories (see CATEGORY), and erecting them by his own sophistical invention into the principles upon which his disputation was to be employed, had the analytical genius of Aristotle presented us with the laws of the true *INDUCTIVE LOGIC*, by which *AXIOMS* are philosophically formed, and had he with his usual sagacity given us an example of it in a single branch of science; he would have brought to the temple of truth an offering more valuable than he has done by the aggregate of all his logical and philosophical productions.

VII. "In all sciences, except the mathematics, it is only after the *INDUCTIVE* process has been industriously pursued and successfully performed, that *DEFINITION* may be logically and usefully introduced, by beginning with the *genus*, passing through all the graduate and subordinate stages, and marking the *specific difference* as it descends, till it arrive at the *individual*, which is the subject of the question. And by adding an *affirmation* or *negation* of the attribute of the *genus* on the *species* or *individual*, or of a general *accident* on the particular *substance* so defined, making the definition a proposition, the truth of the question will be logically solved without any farther process. So that instead of being the *first*, as employed by the logic in common use, *definition* may be the *last* act of reason in the search of truth in general.

VIII. "These *AXIOMS* or general propositions, thus inductively established, become another species of *PRINCIPLES*, which may be properly called *SECONDARY*, and which lay the foundation of the syllogistic method of reasoning. When these are formed, but not before, we may safely admit the maxim with which logicians set out in the exercise of their art, as the great hinge on which their reasoning and disputation turn: *From truths that are already known, to derive others which are not known*. Or, to state it more comprehensively, so as to apply to probable as well as to scientific reasoning—*From truths which are better known, to derive others which are less known*. Philosophically speaking, syllogistic reasoning is, under general propositions to reduce others which are less general or which are particular; for the inferior ones are known to be true, only as we trace their connection with the superior. Logically speaking, it is, To predicate a *genus* of a *species* or *individual* comprehended under it, or an *accident* of the *substance* in which it is inherent.

IX. "Thus *INDUCTION* and *SYLLOGISM* are the two methods of *direct reasoning* corresponding to the two kinds of principles, *primary* and *secondary*, on which they are founded, and by which they are respectively conducted. In both methods, indeed, reason proceeds by *judging* and *comparing*, but the process is different throughout; and though it may have the sanction of Aristotle, an *inductive syllogism* is a solecism.

X. "Till general truths are ascertained by induction, the *third* or *middle terms* by which syllogisms are

made are no where safely to be found. So that another position of the Stagyrice, that *syllogism is naturally prior in order to induction*, is equally unfounded; for *induction* does not only naturally but necessarily precede *syllogism*; and, except in mathematics, is in every respect indispensable to its existence; since, till generala are established, there can be neither *definition*, *proposition*, nor *axiom*, and of course no syllogism. And as induction is the first, so is it the more *essential* and fundamental instrument of reasoning: for as syllogism cannot produce its own *principles*, it must have them from induction; and if the general propositions or secondary principles be imperfectly or infernally established, and much more if they be taken at hazard, upon authority, or by arbitrary assumption like those of Aristotle, all the syllogising in the world is a vain and useless logomachy, only instrumental to the multiplication of false learning, and to the invention and confirmation of error. The truth of syllogisms depends ultimately on the truth of axioms, and the truth of axioms on the soundness of inductions (x)."—But though induction is prior in order, as well as superior in utility, to syllogism, we have here treated it expedient to treat of it last; both because syllogism is an easier exercise of the reasoning faculty than induction, and because it is the method of mathematics, the first science of reason in which the student is commonly initiated.

CHAP. VI. Of Demonstration.

I. HAVING dispatched what seemed necessary to be said with regard to the two methods of direct reasoning, *induction* and *syllogism*; we now proceed to consider the laws of demonstration. And here it must be acknowledged, that in strict demonstration, which removes from the mind all possibility of doubt or error, the inductive method of reasoning can have no place. When the experiments and observations from which the general conclusion is drawn are numerous and extensive, the result of this mode of reasoning is moral certainty; and could the induction be made complete, it would be absolute certainty, equally convincing with mathematical demonstration. But however numerous and extensive the observations and experiments may be upon which an inductive conclusion is established, they must of necessity come short of the number and extent of nature; which, in some cases, by its immensity, will defeat all possibility of their co-extension; and in others, by its distance, lies out of the reach of their immediate application. Though truth does not appear in all other departments of learning with that bold and resistless conviction with which it prevails in the mathematical science, it shines through them all, if not interrupted by prejudice or perverted by error, with a clear and useful, though inferior strength. And as it is not necessary for the general safety or convenience of a traveller, that he should always enjoy the heat and splendor of a mid-day sun, whilst he can with more ease pursue his journey under the weaker influence of a morning or an evening ray; so it is not requisite, for the various concerns and purposes

(x) This chapter is almost wholly taken from *Tatham's Chart and Scale of Truth*; a work which, notwithstanding the ruggedness of its style, has so much real merit as a system of logic, that it cannot be too diligently studied by the young inquirer who wishes to travel by the straight road to the temple of Science.

poses of life, that men should be led by truth of the most redundant brightness. Such truth is to be had only in those sciences which are conversant about ideas and their various relations; where every thing being certainly what it appears to be, definitions and axioms arise from mere intuition. Here *sylogism* takes up the process from the beginning; and by a sublime intellectual motion advances from the simplest axioms to the most complicated speculations, and exhibits truth springing out of its first and purest elements, and spreading on all sides into a system of science. As each step in the progress is syllogistic, we shall endeavour to explain the use and application of syllogisms in this species of reasoning.

209
Of reasoning by a concatenation of syllogisms.

We have seen, that in all the different appearances they put on, we still arrive at a just and legitimate conclusion; now it often happens, that the conclusion of one syllogism becomes a previous proposition in another; by which means great numbers of them are sometimes linked together in a series, and truths are made to follow one another in train. And as in such a concatenation of syllogisms all the various ways of reasoning that are truly conclusive may be with safety introduced; hence it is plain, that in deducing any truth from its first principles, especially where it lies at a considerable distance from them, we are at liberty to combine all the several kinds of syllogisms above explained, according as they are found best to suit the end and purpose of our inquiries. When a proposition is thus, by means of syllogisms, collected from others more evident and known, it is said to be *proved*; so that we may in the general define the proof of a proposition to be a syllogism, or series of syllogisms, collecting that proposition from known and evident truths. But more particularly, if the syllogisms of which the proofs consist admit of no premises but definitions, self-evident truths, and propositions already *demonstrated*, then is the argument so constituted called a *demonstration*; whereby it appears that demonstrations are ultimately founded on definitions and self-evident propositions.

210
All syllogisms whatsoever reducible to the first figure.

II. All syllogisms whatsoever, whether compound, multiform, or defective, are reducible to plain simple syllogisms in some one of the four figures. But this is not all. Syllogisms of the first figure, in particular, admit of all possible conclusions: that is, any propositions whatsoever, whether an universal affirmative or universal negative, a particular affirmative or particular negative, which fourfold division embraces all their varieties; any one of these may be inferred by virtue of some syllogism in the first figure. By this means it happens that the syllogisms of all the other figures are reducible also to syllogisms of the first figure, and may be considered as standing on the same foundation with them. We cannot here demonstrate and explain the manner of this reduction, because it would too much swell the bulk of this treatise. It is enough to take notice that the thing is universally known and allowed among logicians, to whose writings we refer such as desire farther satisfaction in this matter. This then being laid down, it is plain that any demonstration whatsoever may be considered as composed of a series of syllogisms, all in the first figure. For, since all the syllogisms that enter the demonstration are reducible to syllogisms of some one of the four figures; and since the syllogisms of all the

other figures are farther reducible to syllogisms of the first figure, it is evident, that the whole demonstration may be resolved into a series of these last syllogisms. Let us now, if possible, discover the ground upon which the conclusion rests in syllogisms of the first figure; because, by so doing, we shall come at an universal principle of certainty, whence the evidence of all demonstrations in all their parts may be ultimately derived.

III. The rules then of the first figure are briefly these. The middle term is the subject of the major proposition, and the predicate of the minor. The major is always an universal proposition, and the minor always affirmative. Let us now see what effect these rules will have in reasoning. The major is an universal proposition, of which the middle term is the subject, and the predicate of the conclusion the predicate. Hence it appears, that in the major the predicate of the conclusion is always affirmed or denied universally of the middle term. Again the minor is an affirmative proposition, whereof the subject of the conclusion is the subject, and the middle term the predicate. Here then the middle term is affirmed of the subject of the conclusion; that is, the subject of the conclusion is affirmed to be comprehended under, or to make a part of, the middle term. Thus then we see what is done in the premises of a syllogism of the first figure. The predicate of the conclusion is universally affirmed or denied of some idea. The subject of the conclusion is affirmed to be or to make a part of that idea. Hence it naturally and unavoidably follows, that the predicate of the conclusion ought to be affirmed or denied of the subject. To illustrate this by an example, we shall resume one of the syllogisms of the first chapter.

"Every creature possessed of reason and liberty is accountable for his actions:

"Man is a creature possessed of reason and liberty: Therefore man is accountable for his actions."

Here, in the first proposition, the predicate of the conclusion, *accountableness*, is affirmed of all creatures that have reason and liberty. Again, in the second proposition, *man*, the subject of the conclusion, is affirmed to be or to make a part of this class of creatures. Hence the conclusion necessarily and unavoidably follows, *viz.* that man is accountable for his actions; because, if reason and liberty be that which constitutes a creature accountable, and man has reason and liberty, it is plain he has that which constitutes him accountable. In like manner, where the major is a negative proposition, or denies the predicate of the conclusion universally of the middle term, as the minor always asserts the subject of the conclusion to be or make a part of that middle term, it is no less evident that the predicate of the conclusion ought in this case to be denied of the subject. So that the ground of reasoning, in all syllogisms of the first figure, is manifestly this: "Whatever may be affirmed universally of any idea, may be affirmed of every or any number of particulars comprehended under that idea." And again: "Whatever may be denied universally of any idea, may be in like manner denied of every or any number of its individuals." These two propositions are called by logicians the *dictum de omni*, and *dictum de nullo*; and are indeed the great principles

principles of syllogistic reasoning, inasmuch as all conclusions whatsoever either rest immediately upon them, or upon propositions deduced from them. But what adds greatly to their value is, that they are really self-evident truths, and such as we cannot gain say without running into an express contradiction. To affirm, for instance, that *no man is perfect*, and yet argue that *some men are perfect*; or to say that *all men are mortal*, and yet that *some men are not mortal*, is to assert a thing to be and not to be at the same time.

112
Demonstration an infallible guide to truth and certainty.

IV. And now we may affirm, that, in all syllogisms of the first figure, if the premises are true, the conclusion must needs be true. If it be true that the predicate of the conclusion, whether affirmative or negative, agrees universally to some idea; and if it be also true that the subject of the conclusion is a part of or comprehended under that idea; then it necessarily follows, that the predicate of the conclusion agrees also to the subject. For to assert the contrary, would be to run counter to some one of the two principles before established; that is, it would be to maintain an evident contradiction. And thus we are come at last to the point we have been all along endeavouring to establish; namely, that every proposition which can be demonstrated is necessarily true. For as every demonstration may be resolved into a series of syllogisms all in the first figure; and as in any one of these syllogisms, if the premises are true, the conclusion must needs be so too; it evidently follows, that if all the several premises are true, all the several conclusions are so, and consequently the conclusion also of the last syllogism, which is always the proposition to be demonstrated. Now that all the premises of a demonstration are true, will easily appear from the very nature and definition of that form of reasoning. A demonstration, as we have said, is a series of syllogisms, all whose premises are either definitions, self-evident truths, or propositions already established. Definitions are identical propositions, wherein we connect the description of an idea with the name by which we choose to have that idea called, and therefore as to their truth there can be no dispute. Self-evident propositions appear true of themselves, and leave no doubt or uncertainty in the mind. Propositions, before established, are no other than conclusions gained by one or more steps from definitions and self-evident principles, that is, from true premises, and therefore must needs be true. Whence all the previous propositions of a demonstration being, we see, manifestly true; the last conclusion, or proposition to be demonstrated, must be so too. So that demonstration not only leads to certain truth, but we have here also a clear view of the ground and foundation of that certainty. For as, in demonstrating, we may be said to do nothing more than combine a series of syllogisms together, all resting on the same bottom; it is plain that one uniform ground of certainty runs through the whole, and that the conclusions are every where built upon some one of the two principles before established, as the foundation of all our reasoning. These two principles are easily reduced into one, and may be expressed thus: "Whatever predicate, whether affirmative or negative, agrees universally to any idea; the same must needs agree to every or any number of individuals comprehended under that idea." And

thus at length we have, according to our first design, reduced the certainty of demonstration to one simple and universal principle; which carries its own evidence along with it, and which is indeed the ultimate foundation of all syllogistic reasoning.

V. Demonstration therefore serving as an infallible guide to truth, and standing on so sure and unalterable a basis, we may now venture to assert, that the rules of logic furnish a sufficient criterion for the distinguishing between truth and falsehood. For since every proposition that can be demonstrated is necessarily true, he is able to distinguish truth from falsehood who can with certainty judge when a proposition is truly demonstrated. Now, a demonstration is, as we have said, nothing more than a concatenation of syllogisms, all whose premises are definitions, self-evident truths, or propositions previously established. To judge therefore of the validity of a demonstration, we must be able to distinguish whether the definitions that enter it are genuine, and truly descriptive of the ideas they are meant to exhibit: whether the propositions assumed without proofs as intuitive truths have really that self-evidence to which they lay claim: whether the syllogisms are drawn up in due form, and agreeable to the laws of argumentation: in fine, whether they are combined together in a just and orderly manner, so that no demonstrable propositions serve any where as premises unless they are conclusions of previous syllogisms. Now, it is the business of logic, in explaining the several operations of the mind, fully to instruct us in all these points. It teaches the nature and end of definitions, and lays down the rules by which they ought to be framed. It unfolds the several species of propositions, and distinguishes the self-evident from the demonstrable. It delineates also the different forms of syllogisms, and explains the laws of argumentation proper to each. In fine, it describes the manner of combining syllogisms, so as that they may form a train of reasoning, and lead to the successive discovery of truth. The precepts of logic, therefore, as they enable us to judge with certainty when a proposition is duly demonstrated, furnish a sure criterion for the distinguishing between truth and falsehood.

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proof, and of what is still wanting to render it full and complete, enable us to make a due estimate of the measures of probability, and to proportion our assent to the grounds on which the proposition stands. And this is all we can possibly arrive at, or even so much as hope for, in the exercise of faculties so imperfect and limited as ours.

¹¹⁵ The distinction of demonstration into direct and indirect.
 VII. Before we conclude this chapter, it may not be improper to take notice of the distinction of demonstration into *direct* and *indirect*. A *direct demonstration* is, when, beginning with definitions, self-evident propositions, or known and allowed truths, we form a train of syllogisms, and combine them in an orderly manner, continuing the series through a variety of successive steps, until at last we arrive at a syllogism whose conclusion is the proposition to be demonstrated. Proofs of this kind leave no doubt or uncertainty behind them; because, all the several premises being true, the conclusions must be so too, and of course the very last conclusion or proposition to be proved. The other species of demonstration is the *indirect*, or, as it is sometimes called, the *apagogical*. The manner of proceeding here is, by assuming a proposition which directly contradicts that we mean to demonstrate; and thence, by a continued train of reasoning, in the way of a direct demonstration, deducing some absurdity or manifest untruth. For hereupon we conclude, that the proposition assumed was false; and thence again, by an immediate consequence, that the proposition to be demonstrated is true. Thus Euclid, in his third book, being to demonstrate that *circles which touch one another inwardly have not the same centre*, assumes the direct contrary to this, *viz. that they have the same centre*; and thence, by an evident train of reasoning, proves that *a part is equal to the whole*. The supposition therefore leading to this absurdity he concludes to be false, *viz. that circles touching one another inwardly have the same centre*; and thence again immediately infers, that *they have not the same centre*.

¹¹⁶ Ground of reasoning in indirect demonstration.
 VIII. Now, because this manner of demonstration is accounted by some not altogether so clear and satisfactory, we shall therefore endeavour to show, that it equally with the other leads to truth and certainty. Two propositions are said to be *contradictory* one of another, when that which is asserted to be in the one is asserted not to be in the other. Thus the propositions, *Circles that touch one another inwardly have the same centre*, and *Circles that touch one another inwardly have not the same centre*, are contradictory, because the second asserts the direct contrary of what is asserted in the first. Now, in all contradictory propositions, this holds universally, That one of them is necessarily true, and the other necessarily false. For if it be true, that circles which touch one another inwardly have not the same centre; it is unavoidably false, that they have the same centre. On the other hand, if it be false that they have the same centre, it is necessarily true that they have not the same centre. Since therefore it is impossible for them to be both true or both false at the same time; it unavoidably follows, that one is necessarily true, and the other necessarily false. This then being allowed, which is indeed self-evident; if any two contradictory propositions are assumed, and one of them can by a clear train of reasoning be demonstrated to be false, it necessarily follows that the other is

true. For as the one is necessarily true, and the other necessarily false; when we come to discover which is the false proposition, we thereby also know the other to be true.

¹¹⁷ Indirect demonstrations are a sure guide to certainty.
 IX. Now this is precisely the manner of an indirect demonstration, as is evident from the account given of it above. For there we assume a proposition which directly contradicts that we mean to demonstrate; and, having by a continued series of proofs shown it to be false, thence infer that its contradictory, or the proposition to be demonstrated is true. As, therefore, this last conclusion is certain and unavoidable; let us next inquire after what manner we come to be satisfied of the falsehood of the assumed proposition, that so no possible doubt may remain as to the force and validity of demonstrations of this kind. The manner then is plainly this: Beginning with the assumed proposition, we, by the help of definitions, self-evident truths, or propositions already established, continue a series of reasoning, in the way of a direct demonstration, until at length we arrive at some absurdity or known falsehood. Thus Euclid, in the example before-mentioned, from the supposition that circles touching one another inwardly have the same centre, deduces, that *a part is equal to the whole*. Since, therefore, by a due and orderly process of reasoning, we come at last to a false conclusion; it is manifest, that all the premises cannot be true: for, were all the premises true, the last conclusion must be so too, by what has been before demonstrated. Now, as to all the other premises made use of in the course of reasoning, they are manifest and known truths by supposition, as being either definitions, self-evident propositions, or truths previously established. The assumed proposition is that only as to which any doubt or uncertainty remains. That alone, therefore, can be false; and indeed, from what has been already shown, must unavoidably be so. And thus we see, that in indirect demonstrations, two contradictory propositions being laid down, one of which is demonstrated to be false, the other, which is always the proposition to be proved, must necessarily be true; so that here, as well as in the direct way of proof, we arrive at a clear and satisfactory knowledge of truth.

¹¹⁸ A particular case of indirect demonstration.
 X. This is universally the method of reasoning in all apagogical or indirect demonstrations. But if any proposition is assumed, from which, in a direct train of reasoning, we can deduce its contradictory; the proposition so assumed is false, and the contradictory one true. For if we suppose the assumed proposition to be true, then, since all the other premises that enter the demonstration are also true, we shall have a series of reasoning consisting wholly of true premises; whence the last conclusion or contradictory of the assumed proposition must be true likewise: so that by this means we should have two contradictory propositions both true at the same time, which is manifestly impossible. The assumed proposition, therefore, whence this absurdity flows, must necessarily be false; and consequently its contradictory, which is here the proposition deduced from it, must be true. If then any proposition is proposed to be demonstrated, and we assume the contradictory of that proposition, and thence directly infer the proposition to be demonstrated; by this very means we know that the proposition so inferred,

ferred is true. For, since from an assumed proposition we have deduced its contradictory, we are thereby certain that the assumed proposition is false; and if so, then its contradictory, or that deduced from it, which in this case is the same with the proposition to be demonstrated, must be true.

119
A due knowledge of the principles of logic indispensably necessary to make us proper judges of demonstration.

XI. We have a curious instance of this in the twelfth proposition of the ninth book of the Elements. Euclid there proposes to demonstrate, that in any series of numbers, rising from unity in geometrical progression, all the prime numbers that measure the last term in the series will also measure the next after unity. In order to this, he assumes the contradictory of the proposition to be demonstrated; namely, that some prime number measuring the last term in the series does not measure the next after unity; and thence, by a continued train of reasoning, proves that it actually does measure it. Hereupon he concludes the assumed proposition to be false; and that which is deduced from it, or its contradictory, which is the very proposition he proposed to demonstrate, to be true. Now that this is a just and conclusive way of reasoning, is abundantly manifest from what we have so clearly established above. Whence it appears, how necessary some knowledge of the rules of logic is, to enable us to judge of the force, justness, and validity, of demonstrations. For, though it is readily allowed, that by the mere strength of our natural faculties we can at once discern, that of two contradictory propositions, the one is necessarily true, and the other necessarily false; yet

when they are so linked together in a demonstration, as that the one serves as a previous proposition whence the other is deduced, it does not so immediately appear, without some knowledge of the principles of logic, why that alone, which is collected by reasoning, ought to be embraced as true, and the other, whence it is collected, to be rejected as false.

XII. Having thus sufficiently evinced the certainty of demonstration in all its branches, and shown the rules by which we ought to proceed, in order to arrive at a just conclusion, according to the various ways of arguing made use of; it is needless to enter upon a particular consideration of those several species of false reasoning which logicians distinguish by the name of *sophisms*. He that thoroughly understands the form and structure of a good argument, will of himself readily discern every deviation from it. And although *sophisms* have been divided into many classes, which are all called by sounding names, that therefore carry in them much appearance of learning; yet are the errors themselves so very palpable and obvious, that it would be lost labour to write for a man capable of being misled by them. Here, therefore, we choose to conclude this part of logic; and shall in the next give some account of *Method*: which, though inseparable from reasoning, is nevertheless always considered by logicians as a distinct operation of the mind; because its influence is not confined to the mere exercise of the reasoning faculty, but extends in some degree to all the transactions of the understanding.

PART IV. OF METHOD.

121
The understanding sometimes employed in putting together known truths.

WE have now done with the three first operations of the mind, whose office it is to search after truth, and enlarge the bounds of human knowledge. There is yet a fourth, which regards the disposal and arrangement of our thoughts, when we endeavour so to put them together as that their mutual connection and dependence may be clearly seen. This is what logicians call *Method*, and place always the last in order in explaining the powers of the understanding; because it necessarily supposes a previous exercise of our other faculties, and some progress made in knowledge before we can exert it in any extensive degree.

122
Sometimes in the search and discovery of such as are unknown.

II. In this view, it is plain that we must be beforehand well acquainted with the truths we are to combine together; otherwise, how could we discern their several connections and relations, or so dispose of them as their mutual dependence may require? But it often happens, that the understanding is employed, not in the arrangement and composition of known truths, but in the search and discovery of such as are unknown. And here the manner of proceeding is very different. We assemble at once our whole stock of knowledge relating to any subject, and, after a general survey of things, begin with examining them separately and by parts. Hence it comes to pass, that whereas, at our first setting out, we were acquainted only with some of the grand strokes and outlines of truth; by thus pursuing her through her several windings and recesses, we gradually discover those more inward and finer touches whence she derives all her strength, symmetry, and beauty. And here it

is, that when, by a narrow scrutiny into things, we have unravelled any part of knowledge, and traced it to its first and original principles, inasmuch that the whole frame and contexture of it lies open to the view of the mind; here it is, that, taking it the contrary way, and beginning with these principles, we can so adjust and put together the parts as the order and method of science requires.

III. But as these things are best understood when illustrated by examples; let us suppose any machine, for instance a watch, presented to us, whose structure and composition we are as yet unacquainted with, but want, if possible, to discover. The manner of proceeding, in this case, is, by taking the whole to pieces, and examining the parts separately, one after another. When, by such a scrutiny, we have thoroughly informed ourselves of the frame and contexture of each, we then compare them together, in order to judge of their mutual action and influence. By this means we gradually trace out the inward make and composition of the whole, and come at length to discern how parts of such a form, and so put together as we found in unravelling and taking them asunder, constitute that particular machine called a *watch*, and contribute to all the several motions and phenomena observable in it. This discovery being made, we can take things the contrary way, and beginning with the parts, so dispose and connect them as their several uses and structures require, until at length we arrive at the whole itself, from the unravelling of which those parts resulted.

123
Illustrated by the simile of a watch.

124
Ground of
the analy-
tic and syn-
thetic me-
thods.

IV. And as it is in tracing and examining the works of art; so is it, in a great measure, in unfolding any part of human knowledge: for the relations and mutual habitudes of things do not always immediately appear upon comparing them one with another. Hence we have recourse to intermediate ideas; and, by means of them, are furnished with those previous propositions that lead to the conclusion we are in quest of. And if it so happen that the previous propositions themselves are not sufficiently evident, we endeavour, by new middle terms, to ascertain their truth; still tracing things backward, in a continual series, until at length we arrive at some syllogism where the premises are first and self-evident principles. This done, we become perfectly satisfied as to the truth of all the conclusions we have passed through, inasmuch as they are now seen to stand upon the firm and immovable foundation of our intuitive perceptions. And as we arrived at this certainty by tracing things backward to the original principles whence they flow; so may we at any time renew it by a direct contrary process, if, beginning with these principles, we carry the train of our thoughts forward until they lead us, by a connected chain of proofs, to the very last conclusion of the series.

125
Division of
method into
analytic and
synthetic.

V. Hence it appears, that, in disposing and putting together our thoughts, either for our own use, that the discoveries we have made may at all times lie open to the review of the mind, or where we mean to communicate and unfold the discoveries to others, there are two ways of proceeding equally within our choice: for we may so propose the truths relating to any part of knowledge, as they presented themselves to the mind in the manner of investigation; carrying on the series of proofs, in a reverse order, until they at last terminate in first principles: or, beginning with these principles, we may take the contrary way, and from them deduce, by a direct train of reasoning, all the several propositions we want to establish. This diversity in the manner of arranging our thoughts gives rise to the twofold division of method established among logicians: for method, according to their use of the word, is nothing else but the order and disposition of our thoughts relating to any subject. When truths are so proposed and put together as they were or might have been discovered, this is called the *analytic method*, or the *method of resolution*; inasmuch as it traces things backward to their source, and resolves knowledge into its first and original principles. When, on the other hand, they are deduced from these principles, and connected according to their mutual dependence, inasmuch that the truths first in order tend always to the demonstration of those that follow; this constitutes what we call the *synthetic method*, or *method of composition*. For here we proceed by gathering together the several scattered parts of knowledge, and combining them into one whole or system, in such manner that the understanding is enabled distinctly to follow truth through all her different stages and gradations.

126
Called o-
therwise
the method
of inven-
tion, and
the method
of science.

VI. There is this farther to be taken notice of, in relation to these two species of method; that the first has also obtained the name of the *method of invention*, because it observes the order in which our thoughts succeed one another in the invention or discovery of truth. The other, again, is often denominated the

method of doctrine or instruction; inasmuch as, in laying our thoughts before others, we generally choose to proceed in the synthetic manner, deducing them from their first principles. For we are to observe, that although there is great pleasure in pursuing truth in the method of investigation, because it places us in the condition of the inventor, and shows the particular train and process of thinking by which he arrived at his discoveries; yet it is not so well accommodated to the purposes of evidence and conviction. For, at our first setting out, we are commonly unable to divine where the analysis will lead us; inasmuch that our researches are for some time little better than a mere groping in the dark. And even after light begins to break in upon us, we are still obliged to many reviews, and a frequent comparison of the several steps of the investigation among themselves. Nay, when we have unravelled the whole, and reached the very foundation on which our discoveries stand, all our certainty, in regard to their truth, will be found in a great measure to arise from that connection we are now able to discern between them and first principles, taken in the order of composition. But in the synthetic manner of disposing our thoughts, the case is quite different: for as we here begin with the intuitive truths, and advance by regular deductions from them, every step of the procedure brings evidence and conviction along with it; so that, in our progress from one part of knowledge to another, we have always a clear perception of the ground on which our assent rests. In communicating therefore our discoveries to others, this method is apparently to be chosen, as it wonderfully improves and enlightens the understanding, and leads to an immediate perception of truth.

VII. The logic which for so many ages kept possession of the schools, and was deemed the most important of the sciences, has long been condemned as a mere art of wrangling, of very little use in the pursuit of truth. Attempts have been made to restore it to credit, but without success; and of late years little or no attention whatever has been paid to the *art of reasoning* in the course of what is called a liberal education. As both extremes may be faulty, it should seem that we cannot conclude this short treatise more properly than with the following

REFLECTIONS on the UTILITY of LOGIC.

IF Aristotle was not the inventor of logic, he was certainly the prince of logicians. The whole theory of syllogisms he claims as his own, and as the fruit of much time and labour; and it is universally known, that the later writers on the art have borrowed their materials almost entirely from his *Organon* and Porphyry's Introduction. But after men had laboured near 2000 years in search of truth by the help of syllogisms, Lord Bacon proposed the method of induction, as a more effectual engine for that purpose; and since his days the art of logic has gradually fallen into disrepute.

To this consequence many causes contributed. The art of syllogism is admirably calculated for wrangling; and by the schoolmen it was employed with too much success, to keep in countenance the absurdities of the Romish church. Under their management it produced numberless disputes, and numberless sects, who

fought against each other with much animosity without gaining or losing ground; but it did nothing considerable for the benefit of human life, whilst the method of induction has improved arts and increased knowledge. It is no wonder, therefore, that the excessive admiration of Aristotle, which continued for so many ages, should end in an undue contempt; and that the high esteem of logic, as the grand engine of science, should at last make way for too unfavourable an opinion, which seems now prevalent, of its being unworthy of a place in a liberal education. Men rarely leave one extreme without running into the contrary: Those who think according to the fashion, will be as prone to go into the present extreme as their grandfathers were to go into the former; and even they who in general think for themselves, when they are offended at the abuse of any thing, are too apt to entertain prejudices against the thing itself. "In practice (says the learned WARBURTON †), logic is more a trick than a science, formed rather to amuse than to instruct. And in some fort we may apply to the art of syllogism what a man of wit says of rhetoric, that it only tells us how to name those tools which nature had before put into our hands. In the service of chicane, indeed, it is a meer juggler's knot, now fast, now loose; and the schools where this legerdemain was exercised in great perfection are full of the stories of its wonders." The authority of Warburton is great; but it may be counterbalanced by another which, on subjects of this nature, is confessedly greater.

"Laying aside prejudice, whether fashionable or unfashionable, let us consider (says Dr REID ‡) whether logic is or may be made subservient to any good purpose. Its professed end is, to teach men to think, to judge, and to reason, with precision and accuracy. No man will say that this is a matter of little importance: the only thing therefore that can admit of doubt is, whether it can be taught?"

"To resolve this doubt, it may be observed, that our rational faculty is the gift of God, given to men in very different measures: Some have a large portion, some a less; and where there is a remarkable defect of the natural power, it cannot be supplied by any culture. But this natural power, even where it is the strongest, may lie dead for want of the means of improvement. Many a savage may have been born with as good faculties as a Newton, a Bacon, or an Aristotle; but their talents were buried by having never been put to use, whilst those of the philosophers were cultivated to the best advantage. It may likewise be observed, that the chief mean of improving our rational power, is the vigorous exercise of it in various ways and on different subjects, by which the habit is acquired of exercising it properly. Without such exercise, and good sense over and above, a man who has studied logic all his life may be only a petulant wrangler, without true judgment or skill of reasoning in any science."

This must have been Locke's meaning, when in his Thoughts on Education he says, "If you would have your son to reason well, let him read Chillingworth." The state of things is much altered since Locke wrote: Logic has been much improved chiefly by his writings; and yet much less stress is laid upon it, and less time consumed in its study. His counsel, therefore, was ju-

dicious and seasonable; to wit, That the improvement of our reasoning power is to be expected much more, from an intimate acquaintance with the authors who reason best, than from studying voluminous systems of school logic. But if he had meant, that the study of logic was of no use, nor deserved any attention, he surely would not have taken the pains to make so considerable an addition to it, by his *Essay on the Human Understanding*, and by his *Thoughts on the Conduct of the Understanding*; nor would he have remitted his pupil to *Chillingworth's*, the acutest logician as well as the best reasoner of his age."

There is no study better fitted to exercise and strengthen the reasoning powers than that of the mathematical sciences; because there is no other branch of science which gives such scope to long and accurate trains of reasoning, or in which there is so little room for authority or prejudice of any kind to give a false bias to the judgment. When a youth of moderate parts begins to study Euclid, every thing is new to him: His apprehension is unsteady; his judgment is feeble; and rests partly upon the evidence of the thing, and partly upon the authority of his teacher. But every time he goes over the definitions, the axioms, the elementary propositions, more light breaks in upon him; and as he advances, the road of demonstration becomes smooth and easy: he can walk in it firmly, and take wider steps, till at last he acquires the habit not only of understanding a demonstration, but of discovering and demonstrating mathematical truths.

It must indeed be confessed, that a man without the rules of logic may acquire a habit of reasoning justly in *mathematics*, and perhaps in any other science. Good sense, good examples, and assiduous exercise, may bring a man to reason justly and acutely in his own profession without rules. But whoever thinks, that from this concession he may infer the inutilty of logic, betrays by this inference a great want of that art; for he might as well infer, because a man may go from Edinburgh to London by the way of Paris, that therefore any other road is useless.

There is perhaps no art which may not be acquired, in a very considerable degree, by example and practice, without reducing it to rules. But practice joined with rules may carry a man forward in his art farther and more quickly than practice without rules.—Every ingenious artist knows the utility of having his art reduced to rules, and thereby made a science. By rules he is enlightened in his practice, and works with more assurance. They enable him sometimes to correct his own errors, and often to detect the errors of others; and he finds them of great use to confirm his judgment, to justify what is right, and to condemn what is wrong. Now mathematics are the noblest *praxis* of logic. Through them we may perceive how the stated forms of syllogism are exemplified in one subject, namely the predicament of quantity; and by marking the force of these forms, as they are there applied, we may be enabled to apply them of ourselves elsewhere. Whoever, therefore, will study mathematics with this view, will become not only by mathematics a more expert logician, and by logic a more rational mathematician, but a wiser philosopher, and an acuter reasoner, in all the possible subjects either of science or deliberation. But when mathematics, instead of being applied to this ex-

† Introduction to Julian, &c.

‡ Appendix to Lord Kames's Sketch on the Principles and Progress of Reason.

cellent purpose, are used not to exemplify logic, but to supply its place; no wonder if logic fall into contempt, and if mathematics, instead of furthering science, become in fact an obstacle. For when men, knowing nothing of that reasoning which is *universal*, come to attach themselves for years to a *single species*, a species wholly involved in *lines and numbers*, the mind becomes incapacitated for reasoning at large, and especially in the search of *moral truth*. The object of mathematics is *demonstration*; and whatever in that science is not demonstration, is nothing, or at least below the sublime inquirer's regard. *Probability*, through its almost infinite degrees, from simple ignorance up to absolute certainty, is the *terra incognita* of the mathematician. And yet here it is that the great *business* of the human mind is carried on in the search and discovery of all the important truths which concern us as reasonable beings. And here too it is that all its *vigour* is exerted: for to proportion the assent to the probability accompanying every varying degree of moral evidence, requires the most enlarged and sovereign exercise of reason.

In reasonings of this kind, will any man pretend that it is of no use to be well acquainted with the various powers of the mind by which we reason? Is it of no use to resolve the various kinds of reasoning into their simple elements; and to discover, as far as we are able, the rules by which these elements are combined in judging and in reasoning? Is it of no use to mark the various fallacies in reasoning, by which even the most ingenious men have been led into error? It must surely betray great want of understanding, to think these things useless or unimportant. Now these are the things which logicians have attempted; and which they have executed—not indeed so completely as to leave no room for improvement, but in such a manner as to give very considerable aid to our reasoning powers. That the principles they have laid down with regard to definition and division, with regard to the conversion and opposition of propositions, and the general rules of reasoning, are not without use, is sufficiently apparent from the blunders committed daily by those who disdain any acquaintance with them.

Although the art of categorical syllogism is confessedly little fitted for the discovery of unknown truth,

it may yet be employed to excellent purposes, as it is perhaps the most compendious method of detecting a fallacy. A man in quest of unknown truths must generally proceed by the way of induction, from effects to causes; but he, who as a teacher is to inculcate any system upon others, begins with one or more self-evident truths, and proceeds in the way of demonstration, to the conclusion which he wishes to establish. Now every demonstration, as has been already observed, may be resolved into a series of syllogisms, of which the conclusion of the preceding always enters into the premises of that which follows: and if the first principles be clear and evident, and every syllogism in some legitimate mode and figure, the conclusion of the whole must infallibly be admitted. But when the demonstration is thus broken into parts; if we find that the conclusion of one syllogism will not, without altering the meaning of the terms, enter legitimately into the premises of that which should immediately follow; or, supposing it to make one of the premises of a *new* syllogism, if we find that the conclusion, resulting from the whole series *thus* obtained, is different from that of the demonstration; we may, in either of these cases, rest assured that the author's reasoning is fallacious, and leads to error; and that if it carried an appearance of conviction before it was thus resolved into its elementary parts, it must have been owing to the inability of the mind to comprehend at *once* a long train of arguments. Whoever wishes to see the syllogistic art employed for this purpose, and to be convinced of the truth of what we have said respecting its utility, may consult the excellent writer recommended by Locke, who, in places innumerable of his incomparable book, has, without pedantry, even in that pedantic age, made the happiest application of the rules of logic for unravelling the sophistry of his Jesuitical antagonist.

Upon the whole, then, though we readily acknowledge that much time was wasted by our forefathers in syllogistic wrangling, and what might with little impropriety be termed the *mechanical* part of logic; yet the art of forming and examining arguments is certainly an attainment not unworthy the ambition of that being whose highest honour is to be endued with reason.

L O G

L O G

Logiste,
Logograp-
hy.

LOGISTÆ, certain officers at Athens, in number ten, whose business consisted in receiving and passing the accounts of magistrates when they went out of office. The *logistæ* were elected by lot, and had ten *euthyni* or auditors of accounts under them.

LOGOGRAPHY, a new method of printing, in which the types, instead of answering only to single letters, are made to correspond to whole words.

This method, though seemingly a retrograde procession in the printing art, has lately obtained the sanction of his Majesty's patent, and has for some time been actually put in execution in the way of trade, apparently with advantage to the proprietors. In the year 1783, a treatise upon this subject appeared, by Henry Johnson, in which the origin as well as

the utility of the art are fully laid down, and the matter set forth in such a light as can scarce allow us to doubt that it is an improvement in the art. Mr Johnson informs us, that about five years before, viz. in the year 1778, intending to publish a daily list of blanks and prizes in the lottery numerically arranged, he found it could not be accomplished in time by the ordinary way of printing. On this account he procured types of two, three, or more figures as was necessary for his purpose; and thus any entire number might as readily be taken up as if it had been a single type. His next attempt was in forming some large mercantile tables of pounds, shillings, pence, and farthings. For these he procured types expressive of any sum of money ready composed and united, "by
which.

Logograp-
hy.

Logog-
raphy.

which (says he) every species of figure-printing could be performed for the tenth part of the cost, printers always charging it double the price of letter printing." Having thus succeeded to his wish in his two first attempts, he next began to consider if the method could not be applied to words; and in this also the success was equal.

The properties of the logographic art, according to our author, are, 1. That the compositor shall have less charged upon his memory than in the common way. 2. It is much less liable to error. 3. The type of each word is as easily laid hold of as that of a single letter. 4. The decomposition is much more readily performed, even by the merest novices, than they now decompose letters. 5. No extraordinary expence nor greater number of types is required in the logographic than in the common method of printing.

The first of these positions is proved by our author in the following manner. In the common method, the compositor has 150 divisions to which there is no reference, and the printing offices are not agreed with respect to the mode of placing their boxes; "but under this improvement, he has only to know the letters of the alphabet, and is assisted with an index of them, inasmuch that the simplicity of the latter apparatus enables him, by a little practice, to lay his finger almost blindfold on the word required; and the meanest capacity is equal to this mental exercise, having little more to do than knowing by inspection the difference between words under three and those above three syllables; and all the apparatus being within a compass not a great deal more extended than common printing, for these reasons he is as soon possessed of his type of a word as they are of a single letter."

Thus the first and third positions may be said to be proved; but in his proof of the second, our author himself shows that his art is not infallible, by substituting the word *third* instead of *second*. Substitutions of this kind, he owns, may readily take place; but such errors are much more conspicuous than literal ones, though they may be corrected with equal ease; "for the erroneous substitution cannot fail of being nearly equal in length to the word required; although, even otherwise, it would not be attended with greater disadvantage than in the common way, and it would be rectified with greater facility."

The ease with which the composition is performed, shows that there must be an equal ease in performing the decomposition; "from whence (says Mr Johnson)" it is further demonstrable, that any work can be composed by this method nearly as soon as it can be deliberately read; and as to the fifth position, that it shall not require a greater expence of types, it is answered, that it is impossible for more types of letters to be wanted for this method than by any other printer according to the equal quantity of business to be performed, every office having certain known quantities of each letter called a *fount*. A printer's fount contains about 92,500 letters, and our want is not more; nay, nearer the truth, the present quantity for a fount containing much more of some letters than necessary, and fewer of others; which arises from the calculation of the quantity of each letter wanted being adhered to since the old spelling.

Logog-
raphy.

Our author now proceeds to demonstrate that the number of types must necessarily decrease as they are combined into syllables, and much more when formed into words. The whole art of arranging the words consists in placing them under as few divisions as possible, and fill fewer subdivisions; which is attained by the following process.

1. A collection of words, with the addition of tenses, plurals, and degrees of comparison, amounting to more than 100,000, was made from the best English dictionaries.

2. Collections were made from the miscellaneous part of 20 newspapers, the *Spectator*, and Common Prayer-book. The method was, by procuring duplicates of every sheet, so that each alternate side might be pasted over with white paper, in order to leave the whole of the words on both sides perfect; and thus the whole might be touched with less danger of injury than otherwise could have been done. The confusion arising from the parts of other words being seen from the opposite side was likewise prevented.

3. The words, being separately cut out, were then put into a case marked with the divisions from one to 16, according to the number of letters contained in each word. Thus several letters were distinctly collected; and then each separate parcel sorted in a case containing 26 divisions, marked with the letters of the alphabet, according to the commencing letter of the word; and thus all the words were ranged alphabetically, consisting of two, three, four, or five letters, in separate parcels.

4. The same words were then placed together, and poised into an alphabet, with the number of times marked to each that had occurred on the whole; that in this manner a proportion might be determined how many times particular words ought to be repeated for the printing of one sheet, and also to know what words are in general use: There are likewise a number of technical terms, and favourite phrases a great number of times repeated almost by every author, but though these occur throughout the whole book in great proportion to the rest, no more of them will be necessary than what suffice for a single sheet.

5. The whole of the above might be done without the trouble just mentioned, by poising every word at once into a transformed alphabet; because the subdivisions of the second and third commencing letter of each word for references are now obtained, and thus can easily be placed in its proper division, and may be marked as often as it occurs, without repeating the same word; whence we plainly see the ease and expedition of it, from the facility and expedition of poising every word from a leaf in any book. Before such subdivisions were known, they could only have been placed under the first commencing letter of the word; which would cause such a multiplicity of repetitions, that it would take up more time, be far more liable to error, and require more subordinate poissings to bring them into arrangement; so that they may be found more easily than by the above proceedings. Thus also a collection will be obtained of single and double words, which are constantly required from 20 to 400 or 500 times in the printing one sheet of any work whatever; and which alone would abridge the compositor's work near one-third. This second process

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likewise enabled the author to reject, out of the first collection, obsolete words, technical terms, &c. which reduces the original collection to one fifth part.

6. By proceeding in this manner, several species of words are omitted in the founts. 1. Obsolete words; because they occur so seldom, that the difference of time lost in composing them in the ordinary method would be imperceptible. 2. Technical terms, names of places, animals, &c.; though, for any particular work, the terms peculiar to it may be added to the fount in a bifurmed alphabet apart. 3. Real compounds, or words that may be compounded of others, are also rejected; because we actually have the words already, and they may be joined with sufficient expedition, though the spaces are annexed to each, by being constructed accordingly. 4. Those of the same spelling are likewise omitted, though they bear different significations, for obvious reasons.

7. The variation of tenses, degrees of comparison, and numerous words in the English language, having in general the same terminations, such as ED, ING, LY, MENT, NESS, &c. an alphabet may be formed of such a kind as is capable of being annexed to the absolute words or radices, as expeditiously as the whole word could be found in the fount, from its being thereby so much less extended. Thus, by dividing several words into their radices and terminations, many other words may be formed from the radix by the addition of various terminations, and each termination may be added to other radices to which they are applicable.

8. Some radices are imperfect, viz. such as end with the vowel *e*, which must therefore be added in the usual way of composition. Thus, in the word *adore*, the radix is *ador*, to which the terminations *es*, *ed*, *eth*, *er*, *ing*, may be added occasionally.

9. By rejecting also the words which come under this last denomination, the number necessary for a fount is reduced to one-tenth of what it would otherwise be, as will appear evident from the following considerations: 1. There are at least 42 verbs, the infinitive of which ends in *ify*; as *qualify*, *signify*; the radices of which are *qual*, *sign*; the terminations are, *ifies*, *ified*, *ifying*, &c. And Mr Johnson informs us, that by applying these radices to other terminations, he was enabled to dispense with more than 500 words which would otherwise have been necessary. 2. For all regular verbs, no more than six terminations are necessary, viz. *t*, *eth*, *ed*, *es*, *ing*. There are but few irregular ones in the English language; whence it happens that 12 or 14 words may be formed from one single perfect verb as a radix, and many imperfect ones have double that number.

10. By using only the set of terminations which may be contained in a box of two feet square, the common operation of printing would be shortened nearly one half; and in order to find out those which are most in use, and fittest to retain, our author digested them alphabetically, with the radices, words, or syllables, which make complete words annexed to them. Thus,

tain	}	abs—apper—after
—s		de—dis—con
—ed		cer—cap—cur
—ing		enter—main—re—fus, &c.
—ment		

11. Thus it will be found, that out of more than 100,000 words of which the English language consists, there will not be wanted much above 3,000 for a complete fount. This will be very evident to any person who consults a dictionary. He will there find, that a vast number of words require an explanation; whereas in any miscellaneous work, there are none but what can be understood most readily either together or apart. Newspapers retain more of the uncommon kind of words than any others. "The vocabulary (says our author) or alphabet as it is called, of the Chinese, consists of above 80,000 letters or characters; yet he is admitted a master of the language who knows about 4000 of them, no more being in general use."

The expedition with which the logographic method of printing can be accomplished, depends essentially on their arrangement; which, from great numbers of experiments, our author found to be best accomplished in the following manner: 1. Words of one, two, or three syllables, are alphabetically placed by themselves, including all possible commencing syllables, by which the compositor cannot fail of finding the word either in whole or in part let it be what it will; and when the whole cannot be found at once, the remainder may easily be found in single or double syllables among the terminations. 2. All words above three syllables have the same alphabetical arrangement; the terminations being the same at the bottom of each. Experience shows, that by a very few lessons, the meanest capacity may determine the number of syllables, and refer to the particular case containing words of that number, there being conspicuous references to each; and by thus equalizing them, any person may possess himself very expeditiously of what he wants. Even boys who scarce knew more than the letters of the alphabet, were hardly a fortnight employed in this method, when they could at the first glance tell the number of letters contained in any word.

By this simplicity of arrangement, any intelligent person, who never composed in his life, by being placed in a room with the apparatus, could compose and print, without other previous instruction than desiring him to remember that the words under three syllables, and those above three, are placed in separate alphabets; and that whenever he wants a word, the first letter is seen in capitals of two inches on the walls, the second in letters of one inch in right lines; and where it is necessary to have more columns than one for such second letter, the third is given in red down the column, comprehending about 12 divisions, to contain the types of the word coming under such reference.

To exemplify this method as far as it can be done without actually seeing the apparatus, our author instances the two words *above* and *Unfortunately*. In looking for the former, the first letter, A, is seen upon the wall as already mentioned; the second, B, is on the case under it, and down that column is OVE, opposite to the cell containing the types of the whole word; which would be only three references instead of five with spaces, as in the common method. The other word, viz. *Unfortunately*, may be found by the same references, though it contains 13 letters; but "admitting that practice will give the word as soon as a single letter, the average will be found eight for one."—Our author's explanation of the method in which this word might be composed, however, seems by

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by no means intelligible.—“For this distinction in the cafes (says he), the alphabet, or rather marks of first reference in large characters on the wall, is divided into two classes, not as vowels and consonants, but as follows, *viz.* A, Con, Dis, E, In, O, P, S, Un, commencing references, the second or subsequent letters of the words being in a right line from left to right, and down each column is found the remainder of the reference to the words, distinguishing always the third letter in red. The second distinction is, that for all other commencing letters, the second letter of reference is in a column down, and the third letter in lines from left to right in red.

These are the directions given by our author for forming a fount of words; the next requisite is a fount of syllables, formed in the following method: 1. A complete set of two letters was obtained in all their possible combinations, amounting to 676. 2. Having next obtained the possible combination of these letters, *viz.* 17,576, by retaining only all possible syllables, and words of three letters, it is reduced to the 30th part, which answer all the purposes of composing with syllables of two and three letters, for Latin, French, English, and all names of persons, places, and things, every possible syllable being comprehended among them. Hence it forms an universal triformed alphabet, where English characters are used; from whence all partial bi-formed and tri-formed alphabets in the arrangement of English, French, Latin, and all technical matters, are drawn. Though combinations of four letters are again 26 times the number of those of three letters, and five letters increase in the same ratio; yet as much as all possible combinations increase in quantity proportionate to the number of letters combined, so they decrease in the actual number of syllables included among them, inasmuch, that all the syllables of four, five, six, and seven letters together, are considerably more than the syllables of three letters only.—Besides the two founts already mentioned, a third was found necessary for such terminations as are most commonly followed by particular punctuations; but, after some consideration, this was judged unnecessary.

Our author now proceeds to obviate some objections which must naturally occur to one who first hears of his invention. These are,

1. A single letter damaged in a word renders the whole useless.

This is not denied by Mr Johnson; but he contends, that the quantity of metal lost in this manner is quite trifling.

2. How are the blanks or spaces in a line to be managed, as these are by no means equal?

To this our author replies, that, at the time of writing the pamphlet, he was undetermined whether it be most eligible to have spaces cast along with the beginnings of words, or to space them in the common manner. The former would be more expeditious; and where a greater distance is required, other spaces may be introduced in the ordinary method.

3. How is a long word at the end of a line to be divided?

This may be easily accomplished by means of the syllabic fount already mentioned.

4. How is the error of substituting one word for another to be rectified?

Nº 186.

The answer to this is, that an error of the kind specified may be corrected in the very same manner as is done in common printing. Long words may be divided by means of the syllabic fount already mentioned, and the intervals between the words may be filled up with spaces as usual.

LOGWOOD. See HÆMATOXYLON.

LOHOCH, or LOCH, in pharmacy, a composition of a middle consistence between a soft electuary and a syrup, principally used in disorders of the lungs.

LOINS, in anatomy, the two lateral parts of the umbilical region of the abdomen.

LOIRE, the largest river in France, rises in the mountains of the Cevennes, and, after running a course of about 500 miles, falls into the bay of Biscay.

LOKE, in mythology, the name of one of the deities of the northern nations, answering to the Arimanes among the Persians, whom they represent as at enmity both with gods and men, and the author of all the evils which desolate the universe. Loke is described in the Edda as producing the great serpent which incircles the world; which seems to have been intended as an emblem of corruption or sin: he also gives birth to Hela or death, the queen of the infernal regions; and also to the wolf Fenris, that monster who is to encounter the gods and destroy the world.

LOKMAN the WISE, an eminent philosopher among the Easterns. The Arabians say he was the son of Baura, the son or grandson of a sister or aunt of Job. He was an Ethiopian, and a slave for some time. It is related that he was born in the time of David, and lived till the age of the prophet Jonas. Some suppose him to have been the same with Æsop the mythologist; and indeed we find in the parables or apologies of Lokman in Arabic, many particulars that are seen in Æsop's fables; so that it is not easy to determine whether the Greek or the Arabian are the originals. He is said to have been deformed in his person; but that this defect was sufficiently made up by the perfections of his mind. Some pieces of his are extant; and he was looked upon as so excellent a person, that Mahomet has inserted a chapter of the Koran, called after his name, in which he introduces God as saying, “We heretofore bestowed wisdom on Lokman.”—It is related that he got his liberty on the following occasion. His master having given him a bitter melon to eat, he eat it all. His master, surprised at his exact obedience, asked, How it was possible for him to eat such a nauseous fruit? He answered, “I have received so many favours from you, that it is no wonder I should once in my life eat a bitter melon from your hand.” This generous answer of the slave struck the master to such a degree, that he immediately gave him his liberty. M. Galland translated all the fables of Lokman, and Bidpai or Pilpay a bramin philosopher, which were published at Paris in 1724.

LOLIUM, DARNELL-GRASS, in botany: A genus of the digynia order, belonging to the triandria class of plants; and in the natural method ranking under the 4th order, *Gramina*. The calyx is monophyllous, fixed, and unisporous. The most remarkable species are, 1. The perenne, red darnel, or rye-grass. This is very common in roads and dry pastures. It makes excellent hay upon dry, chalky, or sandy soils. It is advantageously cultivated along with clover, and
springs

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Lolium.

Lollards. springs earlier than other grasses; thereby supplying food for cattle at a time when it is most difficult to be obtained. Cows, horses, and sheep eat it; goats are not fond of it. 2. The temulentum, or white dandel, grows spontaneously in ploughed fields. If the seeds of this species are malted with barley, the ale soon occasions drunkenness; mixed with bread-corn, they produce but little effect unless the bread is eaten hot.

LOLLARDS, in ecclesiastical history, a religious sect, differing in many religious points from the church of Rome, which arose in Germany about the beginning of the 14th century; so called, as many writers have imagined, from Walter Lollard, who began to dogmatise in 1315, and was burnt at Cologne: though others think that Lollard was no surname, but merely a term of reproach applied to all heretics who concealed the poison of error under the appearance of piety.

The monk of Canterbury derives the origin of the word Lollard among us, from *lollum*, "a tare;" as if the Lollards were the tares sown in Christ's vineyard. Abelly says, that the word Lollard signifies "praising God," from the German *loben*, "to praise," and *herr*, "Lord;" because the Lollards employed themselves in travelling about from place to place, singing psalms and hymns.

Others, much to the same purpose, derive *lollbard*, *lollbard*, or *lollert*, *lullert*, as it was written by the ancient Germans, from the old German word *lullen*, *lollen*, or *lallen*, and the termination *bard*, with which many of the High Dutch words end. *Lollen* signifies "to sing with a low voice;" and therefore Lollard is a singer, or one who frequently sings; and in the vulgar tongue of the Germans it denotes a person who is continually praising God with a song, or singing hymns to his honour. The Alexians or Cellites were called *Lollards*, because they were public singers who made it their business to enter the bodies of those who died of the plague, and sang a dirge over them in a mournful and indistinct tone as they carried them to the grave. The name was afterwards assumed by persons that dishonoured it; for we find, among those Lollards who made extraordinary pretences to piety and religion, and spent the greatest part of their time in meditation, prayer, and such acts of piety, there were many abominable hypocrites, who entertained the most ridiculous opinions and concealed the most enormous vices under the specious mark of this extraordinary profession. And many injurious aspersions were propagated against those who assumed this name by the priests and monks; so that, by degrees, any person who covered heresies or crimes under the appearance of piety, was called a *Lollard*. Thus the name was not used to denote any one particular sect, but was formerly common to all persons and all sects who were supposed to be guilty of impiety towards God or the church, under an external profession of extraordinary piety. However, many societies, consisting both of men and women under the name of *Lollards*, were formed in most parts of Germany and Flanders, and were supported partly by their manual labours, and partly by the charitable donations of pious persons. The magistrates and inhabitants of the towns where these brethren and sisters resided, gave them

particular marks of favour and protection, on account of their great usefulness to the sick and needy. They were thus supported against their malignant rivals, and obtained many papal constitutions by which their institute was confirmed, their persons exempted from the cognisance of the inquisitors, and subjected entirely to the jurisdiction of the bishops; but as these measures were insufficient to secure them from molestation, Charles duke of Burgundy, in the year 1472, obtained a solemn bull from Pope Sixtus IV. ordering that the Cellites or Lollards should be ranked among the religious orders, and delivered from the jurisdiction of the bishops; and Pope Julius II. granted them yet greater privileges in the year 1506. Mosheim informs us that many societies of this kind are still subsisting at Cologne, and in the cities of Flanders, though they have evidently departed from their ancient rules.

Lollard and his followers rejected the sacrifice of the mass, extreme unction, and penances for sin; arguing, that Christ's sufferings were sufficient. He is likewise said to have set aside baptism, as a thing of no effect; and repentance, as not absolutely necessary, &c.—In England, the followers of Wickliffe were called, by way of reproach, *Lollards*, from some affinity there was between some of their tenets; though others are of opinion, that the English Lollards came from Germany.

They were solemnly condemned by the archbishop of Canterbury and the council of Oxford.

LOMBARD (Lambert), an eminent painter, born at Liege in 1500; who, after a diligent study of the antique at Rome, introduced that style of painting among his countrymen instead of the Gothic. He painted history, architecture, and perspective; and though he could never altogether free himself from his national goit, he is ranked among the best painters of his time. He died in 1560.

LOMBARD (Peter), well known by the title of *Myfter of the Sentences*, was born at Novara in Lombardy; but being bred at Paris, he distinguished himself so much at that university, that he first had the canonry of Chartres conferred on him, was some time tutor to Philip son of Louis le Gros, and lastly obtained the see of Paris. He died in 1064. His work of the *Sentences* is looked on as the source of the scholastic theology of the Latin church. He wrote also Commentaries on the Psalms, and on St Paul's Epistles.

LOMBARDS, a Scandinavian nation, who formerly settled in Italy, and for some time made a considerable figure.

Their name of *Lombards*, or *Longobards*, is by some derived from the word *lack*, or *lache*, signifying in the German tongue *winter*; because the Lombards, while in Scandinavia, lived in marshes, or near the sea. Others think that it comes from the two German words *langen barden*, or *bellidorden*, that is, from the long halberds they were supposed to use in war. But Paulus Diaconus their historian, and who was himself a Lombard, tells us, that they were called *Longobards* from the length of their beards. A nation called the *Lombards* is mentioned by Tacitus, Strabo, and Ptolemy; but these are different from the Lombards who afterwards settled in Italy, and are reckoned to be the same with

Lollards
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Lombards.

Eymology
of the
name.

Lombards the Gepidæ, whom the Italian Lombards almost exterminated. The Lombards who settled in Italy are first mentioned by Prosper Aquitanus, bishop of Rhegium in the year 379. That writer tells us, that about this time the Lombards, abandoning the most distant coasts of the ocean, and their native country Scandinavia, and seeking for new settlements, as they were overstocked with people at home, first attacked and overcame about this time the Vandals in Germany. They were then headed by two chiefs, Iboreus and Aion; who, dying about the year 389, were succeeded by Agilmund, who is commonly reckoned the first king of the Lombards.

3 Before the time of Odoacer, the Lombard history affords nothing remarkable; in his time, however, they settled on the Danube, in the country of the Rugians, whom Odoacer had almost totally exterminated or carried into captivity. During their stay in this country, they rendered themselves formidable to the neighbouring nations, and carried on successful wars with the Heruli and Gepidæ. In 526, they were allowed by the emperor Justinian to settle in Pannonia; and here they made war a second time with the Gepidæ. Alboinus, the Lombard king, killed the king of the Gepidæ with his own hand, put his army to the rout, and cut such numbers of them in pieces, that they ceased from that time to be a nation.

4 Having caused the deceased king's head to be cut off, he made a cup of his skull, called in the language of the Lombards *fibula*, which he made use of in all public entertainments. However, having taken, among many other captives of great distinction, the late king's daughter, by name *Rosamunda*, he married her after the death of his former wife Clodivinta, the daughter of Clotaire king of France.

By this victory Alboinus gained such reputation, that his friendship was courted by Justinian; and, in consequence of the emperor's application, a body of 6000 Lombards were sent to the assistance of Narfes against the Goths. The success of the Romans in this expedition, the invasion of Italy by the Lombards, and their successes in that country, have been taken notice of under the article ITALY, n° 28—32. At last Alboinus, having made himself master of Venetia, Liguria, Emilia, Hetruria, and Umbria, was slain by the treachery of his wife, in the year 575, the fourth of his reign. This princess was the daughter of the king of the Gepidæ, whom Alboinus had killed in battle, and made a cup of his skull, as above related.

5 As he was one day feasting at Verona with his chief favourites and principal officers, in the height of his mirth he sent for the queen, and, filling the detested cup, commanded her to drink merrily with her father. Rosamund, struck with horror, hurried out of the room; and highly incensed against her husband for thus barbarously triumphing over the misfortunes of her family, resolved, at all events, to make him pay dear for such an inhuman and affronting conduct. Accordingly, she discovered her intention to Helmichild the king's shield-bearer, a youth of great boldness and intrepidity. Helmichild pre-emptorily refused to imbrue his hands in the blood of his sovereign, or to be any way accessory to his death; and in this resolution he persisted till he was, by a shameful stratagem, forced by the queen to a compliance: for she,

knowing that he carried on an intrigue with one of her ladies, placed herself one night in her bed, and receiving the youth, indulged him as if he had been his own mistress in his amorous desires; which he had no sooner done, than, discovering herself to the deceived lover, she told him that he must now either put the king to death, or be put to death by him. Helmichild, well apprised, that, after what he had done, his safety depended upon the death of the king, engaged in the treason, which he otherwise abhorred. One day, therefore, while Alboinus was repining in his chamber after dinner, Helmichild, with some others whom he had made privy to his design, breaking in unexpectedly, fell upon the king with their daggers. Alboinus, starting up at their first coming in, laid hold of his sword, which he had always by him; but having in vain attempted to draw it, the queen having beforehand fastened it in the scabbard, he defended himself for some time with a footstool; but was in the end overpowered, and dispatched with many wounds.

Rosamund had promised to Helmichild, that, as soon as he had dispatched the king, she would marry him, and, with her person, bestow upon him the kingdom of the Lombards. The first part of her promise she immediately performed; but was so far from being able to bestow the crown upon him, that both of them were obliged to save themselves by flight. They fled to Longinus the exarch of Ravenna, taking with them all the jewels and treasure of the late king. Longinus received her with the greatest marks of friendship and kindness, and assured her of his protection. She had not been long in Ravenna, however, before the exarch, judging that a favourable opportunity now offered of making himself king of Italy by her means, imparted his design to her, and declared his intention to marry her, provided, by some means or other, she dispatched Helmichild.—Rosamund, highly pleased with the proposal, resolved to satisfy her ambition by getting rid of the person whom she had married in order to gratify her revenge. Accordingly, having prepared a strong poison, she mixed it with wine, and gave it to her husband as he came out of the bath, and called for drink, according to his custom. Helmichild had not half emptied the cup, when, by the sudden and strange operation which he felt in his bowels, he concluded what it was; and, with his sword pointed at the queen's breast, compelled her to drink the rest. The poison had the same effect on both; for they died in a few hours. Longinus, on the death of the queen, laid aside all thoughts of making himself king of Italy, and sent the king's treasure to Constantinople, together with Alboinda, the daughter of Alboinus by Rosamund, whom he had brought along with her.

After the death of Alboinus, the Lombards chose Clephis, one of the nobility, for their king. He was murdered after a short reign of 18 months; upon which ensued an interregnum of 10 years, as related under the article ITALY, n° 32. During this time, they extended their conquests in that country; but at last the Romans, jealous of their progress, resolved to put a stop to their victories, and, if possible, to drive them quite out. For this purpose, they designed not only to employ their own force, but entered into alliance with the Franks; which so alarmed the Lombards, that they re-established the monarchical form of government.

Alboinus king of the Lombards assassinated at the instigation of his wife.

6 Her death.

7 Monarchy abolished.

Lombards, vernment among themselves, and chose Autharis the son of Clephis for their king. This monarch, considering that the power of the dukes, who had governed Lombardy for the space of 10 years, was during that length of time very much established, and that they would not probably be willing to part with the authority which they had so long enjoyed, allowed them to continue in their government; but obliged them to contribute one moiety of their revenues towards the maintenance and support of his royal dignity, suffering them to dispose of the other as they thought proper. He reserved to himself the supreme dominion and authority; and took an oath of the dukes, that, in time of war, they would readily assist him to the utmost of their power. Though he could remove the dukes at pleasure, yet he deprived none of them of their dukedoms, except in cases of treason; nor gave them to others, except when their male issue failed. Having settled matters in this manner with the dukes, he enacted several wholesome laws against theft, rapine, murder, adultery, and other vices which prevailed among his subjects, and was the first of the Lombard kings who embraced Christianity. Most of his subjects followed the example of their monarch: but as they were all instructed by Arian bishops, they continued long infected with that heresy; which occasioned great disputes between them and the orthodox bishops of the cities subject to them.

From the re-establishment of the monarchy under Autharis, to the reign of Rotharis in 636, the history of the Lombards affords nothing memorable. This period is remarkable for the introduction of written laws among these people. Before his time they had been governed only by tradition; but Rotharis, in imitation of the Romans and Goths, undertook the publishing of written laws; and to those which he enacted, many were added by the succeeding princes. Grotius prefers the method which the Lombards followed in making laws, to that which was practised by the Romans themselves. Among the latter the emperor was the sole lawgiver; so that whatever pleased him had the force of a law. But the Lombard kings did not assume that power to themselves, since their laws were enacted in public assemblies, convened for that purpose, after they had been maturely examined and approved of by all the lords of the kingdom. From these assemblies were excluded the ecclesiastic order, and the people; so that the legislative power was lodged in the king and nobles alone.

The reign of Rotharis is remarkable, not only for his introducing written laws among his subjects, but for the conquests he made, and the successful wars carried on with the exarch of Ravenna, whom he totally defeated in several engagements, and made himself master of some part of his territories. This monarch died in 652; and the affairs of the Lombards went on prosperously, till the ambition of Luitprand laid the foundation of the total ruin of his kingdom. He ascended the throne of Lombardy in 711, and watched all opportunities of enlarging his dominions at the expence of the emperors. Of this, a fair opportunity offered in 716: for the emperor Leo Isauricus, who at that time reigned in the east, having, by his famous edict, forbidden the worship of images, and ordered them to be every where pulled down, the

people were so provoked at that innovation, that, in several places, they openly revolted, and, falling upon the emperor's officers, drove them out of the cities. In the east, Germannus, patriarch of Constantinople, opposed the emperor's design with great warmth; but Leo caused him to be deposed, and Anastasius to be raised to that see in his room, ordering at the same time all the images in the imperial city to be pulled down and publicly burnt. He strictly enjoined his officers in the west, especially the exarch of Ravenna, to see his edict punctually obeyed in their respective governments. In compliance with these orders, Scholasticus, then exarch, began to pull down the images in all the churches and public places in Ravenna; which incensed the superstitious multitude to such a degree, that, taking arms, they openly declared they would rather renounce their allegiance to the emperor than the worship of images.

Thus a kind of civil war being kindled in the city, Luitprand thought he had now a favourable opportunity of making himself master of the seat of the exarch, not doubting but the conquest of such an important place would be followed by that of the whole exarchate. Having therefore drawn together all his forces, he unexpectedly appeared before Ravenna, and closely besieged it. The exarch little expected such a surprise, as a friendly correspondence had been maintained for many years between the exarchs and the Lombard kings. However, he defended the place with such courage and resolution, that Luitprand, despairing of success, broke up the siege and led his army against Clasis, at a small distance from Ravenna, which he took, plundered, and levelled with the ground. The loss of this place, and the severe treatment the inhabitants met with from the king, threw the citizens of Ravenna into the utmost consternation; which Luitprand being informed of, he resolved to take advantage of their fears, and, returning before Ravenna while the inhabitants were thus disheartened, to attempt once more the reduction of that place. Accordingly he led his whole army against it, and, by frequent attacks, tired the inhabitants and garrison to such a degree, that the exarch, finding they could hold out no longer, and despairing of relief, privately withdrew. Luitprand, informed of his retreat, attacked the town with more violence than ever; and, having carried it by storm, gave it up to be plundered by his soldiers, who found in it an immense booty, as it had been for a long time the seat of the Roman emperors, of the Gothic kings, and the exarchs. The king stripped it of most of its valuable monuments of antiquity, and caused, among the rest, an equestrian statue of an emperor, of wonderful workmanship, to be conveyed to Pavia, where it is to be seen to this day. The reduction of Ravenna was followed by the surrender of several cities of the exarchate, which Luitprand reduced to a dukedom; appointing Hildebrand his grandson to govern it with the title of duke; and giving him, as he was yet an infant, Perekus deus duke of Vicenza for his guardian.

The conquest of Ravenna and the greater part of the exarchate did not a little alarm Gregory II. bishop of Rome. He was then at variance with the emperor, whose edict against the worshipping of images he had opposed with all his might, and by that

Lombards means provoked Leo to such a degree, that he had threatened to drive him from the see, and send him into exile. However, the pope, no less jealous of the power of the Lombards than all his predecessors had been, resolved, by some means or other, to put a stop to their conquests. The only prince in Italy to whom he could have recourse was Ursus duke of Venice, the Venetians making already no inconsiderable figure. To him accordingly he wrote a very pressing letter; conjuring him to assist his worthy son the exarch, and for the love of the holy faith, to attempt with him the recovery of the exarchate, which the wicked nation of the Lombards had unjustly taken from his sons Leo and Constantine emperors. Ursus and the Venetians, moved with the pope's letter, and at the same time greatly alarmed at the growth of so powerful a neighbour, promised to assist the exarch with the whole strength of their republic; and accordingly fitted out a considerable fleet, pretending it was designed for the service of the emperor against the Saracens. At the same time the exarch, who had taken refuge in Venice, abandoning that place, as it were in despair of bringing the duke over to his party, raised, in the places still subject to the emperor, what forces he was able; and having got together a considerable body, he marched with them towards Imola, giving out that he designed to besiege that city; but, turning on a sudden towards Ravenna, as had been agreed on between him and the Venetians, he laid siege to it by land, while they invested it almost at the same instant by sea. Peredeus defended the town for some time with great courage and resolution; obliging all those who were able to bear arms to repair to the walls. But the Venetians having, in spite of all opposition, forced open one of the gates on the side of the sea, the city was taken, and Peredeus slain, while he was attempting, at the head of a choice body, to drive the enemy from the posts they had seized. As for Hildebrand, he fell into the hands of the Venetians; who, having thus recovered Ravenna to the emperor, returned home, leaving the exarch in possession of the city. Luitprand was then at Pavia; but the town was taken before he could assemble his troops to relieve it.

14
Who retake
Ravenna.

And now Gregory bishop of Rome, to whom the recovery of Ravenna was chiefly owing, persuading himself, that the emperor would, out of gratitude, give ear to his remonstrances and admonitions, began to solicit him with more pressing letters than ever to revoke his edict against the worship of images: but Leo, well apprised that the bishop, in all the measures he had taken, had been more influenced by a regard to his own interest, than to that of the empire, instead of hearkening to his remonstrances, was still more provoked against him for thus obstinately opposing the execution of his edict. Being, therefore, resolved at all events to have it observed in Rome itself, and, on the other hand, not doubting but the pope would oppose it to the last with all his might; in order to remove all obstacles, he sent three officers to Rome, with private orders, either to dispatch the pope, or to take him prisoner and convey him to Constantinople. At the same time, he wrote to Mauritius duke of Rome, secretly enjoining him to assist his three officers in their undertaking: but no favourable opportunity offering to put their design in execution, the emperor,

in the year 725, recalled Scholasticus, and sent Paul a patrician into Italy, to govern in his room, with private instructions to encourage the above-mentioned officers with the promise of great rewards, and to assure them of his protection.

But, in the mean time, the plot was discovered, and two of the conspirators were apprehended by the citizens of Rome, and put to death; the third having escaped into a monastery, where he took the monastic habit, and ended his days. Hereupon the exarch, in compliance with the emperor's orders, resolved to proceed no longer by secret plots, but by open force. Accordingly, he drew together a considerable body of troops, and set out at the head of them on his march to Rome, with a design to seize on the pope, and send him, as he had engaged to do, in chains to Constantinople. But, on this occasion, Luitprand, though highly provoked against Gregory for having stirred up the Venetians against him, yet resolved to assist him and the citizens of Rome against the exarch, in order to keep the balance even between them, and by assisting sometimes the one and sometimes the other, weaken both. Pursuant to this resolution, he ordered the Lombards of Tuscan, and those of the dukedom of Spoleto, to join the pope and the inhabitants of Rome; who, being by this reinforcement far superior in strength and number to the exarch, obliged him to return to Ravenna, and give over all thoughts of any further attempt on the person of the pope.

15
Luitprand
assists the
pope against
the exarch.

In the mean time, Leo, persisting in his former resolution of suppressing throughout his dominions the worship of images, sent fresh orders to the exarch Paul, strictly enjoining him to cause his edict to be put in execution in all the cities of Italy under his empire, especially in Rome. At the same time, he wrote to the pope, promising him his favour and protection if he complied with the edict; and declaring him, if he continued to oppose it, a rebel, and no longer vested with the papal dignity. But Gregory was so far from yielding to the emperor's threats or promises, that, on the contrary, he solemnly excommunicated the exarch for attempting to put the imperial edict in execution; and at the same time wrote circular letters to the Venetians, to king Luitprand, to the Lombard dukes, and to all the chief cities of the empire, exhorting them to continue steadfast in the Catholic faith, and to oppose with all their might such a detestable innovation. These letters made such an impression on the minds of the people in Italy, that, though of different interests, and often at war with one another, they all united; protesting they would defend the Catholic faith, and the life of the pope, in so glorious a cause, at the expense of their own: nay, the citizens of Rome, and the inhabitants of Pentapolis, now Marca d'Ancona, not contenting themselves with such a protestation, openly revolted from the emperor; and, pulling down his statues, they elected, by their own authority, magistrates to govern them during the interregnum. We are even told, that, transported with a blind zeal, they were for choosing a new emperor, and conducting him to Constantinople, not doubting but the people would every-where join them. But the pope, thinking this resolution unseasonable, and not to be easily put in execution, opposed it; so that it did not take place.

Lombards.

16
A civil war
in Ravenna

In the mean time, the exarch Paul, having gained a considerable party in Ravenna, began, pursuant to the repeated orders from the emperor, to remove the images, as so many idols, out of the churches. Hereupon the adverse party, supported and encouraged by the pope, flew to arms; and, falling upon the *iconoclasts* or image-breakers, as they styled them, gave rise to a civil war within the walls of Ravenna. Great numbers were killed on both sides: but those who were for the worship of images prevailing in the end, a dreadful slaughter was made of the opposite party; and, among the rest, the exarch himself was murdered. However, the city of Ravenna continued faithful to the emperor; but most of the cities of Romagna belonging to the exarchate, and all those of Pentapolis or La Marca d'Ancona, abhorring the emperor as an heretic, submitted to Luitprand king of the Lombards; who, pretending a zeal for the Catholic religion, took care to improve the discontent of the people to his advantage, by representing to them, that they could never maintain their religious rights under a prince, who was not only an heretic, but a persecutor of the orthodox.

In Naples, Exhilaratus, duke of that city, having received peremptory orders from the emperor to cause his edict to be put in execution, did all that lay in his power to persuade the people to receive it; but finding all his endeavours thwarted by the bishop of Rome, for whom the Neapolitans had a great veneration, he hired assassins to murder him. But the plot being discovered, though carried on with great secrecy, the Neapolitans, highly provoked against the duke, tore both him and his son to pieces, and likewise put to death one of his chief officers, who had composed a libel against the pope. Luitprand, and Gregory at that time duke of Benevento, laying hold of so favourable an opportunity to make themselves masters of the dukedom of Naples, did all that lay in their power to persuade the Neapolitans to submit to them. But the Neapolitans, bearing an irreconcilable hatred to the Lombards, with whom they had been constantly at variance, rejected every overture of that nature with the utmost indignation; and, continuing steadfast in their allegiance to Leo, received from Constantinople one Peter, who was sent to govern them in the room of Exhilaratus. Some writers suppose the Neapolitans, in this general revolt of the cities of Italy, to have shaken off the yoke with the rest, and to have appointed magistrates of their own election to govern them, in the room of the officers hitherto sent from Constantinople, or named by the exarch: but they are certainly mistaken; it being manifest from history, that Peter succeeded Exhilaratus in that dukedom, and that the Neapolitans continued to live under the emperors, till they were conquered many years after by the Normans.

In the mean time, Leo hearing of the murder of the exarch, and the general revolt of the cities, and not doubting but the pope was the chief author of so much mischief, sent the eunuch Eutychius into Italy, with the title and authority of *exarch*, strictly enjoining him to get the pope dispatched by some means or other, since his death was absolutely necessary for the tranquillity of Italy. The exarch spared no pains to get the pope into his power: but a messenger, whom

he had sent to Rome, being apprehended by the citizens, and an order from the emperor being found upon him to all his officers in that city, commanding them to put the pope to death at all events, the pope's friends thereforth guarded him with such care, that the exarch's emissaries could never afterwards find an opportunity of executing their design. As for the messenger, the Romans were for putting him to death; but the pope interposed, contenting himself with communicating the exarch.

And now the Romans, provoked more than ever against Leo, and, on the other hand, unwilling to live under the Lombards, resolved to revolt from the emperor, and appoint their own magistrates, keeping themselves united under the pope, not yet as their prince, but only as their head. This they did accordingly; and from these slender beginnings the sovereignty of the popes in Italy took its rise, though they did not then, as is commonly supposed by historians, but many years after, become sovereign lords of Rome.

Eutychius failed in his design upon the life of the pope; but having brought with him from Constantinople a good number of troops, he easily quelled the rebellion in Ravenna, and severely punished the authors of the late disturbances. As for the rebellious Romans, he was well apprised he could never reduce them, so long as they were supported by the king of the Lombards; and therefore he employed all his art and policy to take off that prince from the party of the Romans, and bring him over to his own.

Luitprand, for some time, withstood all his offers; but Thrafrimund duke of Spolito revolting at this very juncture, the exarch, laying hold of that opportunity, offered to assist the king with all his strength against the rebellious duke, provided he would, in like manner, assist him against the pope and the Romans. With this proposal Luitprand readily closed; and a league being concluded upon these terms between him and the exarch, the two armies joined, and began their march towards Spolito. At their approach, the duke, despairing of being able to resist two such powers, came out with a small attendance to meet them, and, throwing himself at the king's feet, sued, in that humble posture, for pardon; which Luitprand not only granted him, but confirmed him in the dukedom, after he had obliged him to take a new oath of allegiance, and give hostages for his fidelity in time to come. From Spolito, the two armies marched, in pursuance of the treaty, to Rome; and encamped in the meadows of Nero, between the Tiber and the Vatican.

Gregory had caused the city of Rome to be fortified in the best manner he could: but being sensible that the Romans alone could not long hold out against two such armies, and reflecting on the kind treatment the duke of Spolito had met with upon his submitting to the king, he resolved to follow his example; and accordingly, taking with him some of the clergy, and the principal inhabitants of the city, he went to wait on the king in his camp; and there, with a pathetic speech, as he was a great master of eloquence, softened Luitprand to such a degree, that, throwing himself at his feet in the presence of the whole army, he begged pardon for entering into an alliance against him;

Lombards.

17
The Ro-
mans re-
volt.18
Luitprand
submit to
an alliance
with the
exarch.19
The pope
submits to
Luitprand.

Lombards. him : and, assuring him of his protection for the future, he went with him to the church of St Peter ; and there, disarming himself in the presence of his chief officers, he laid his girdle, his sword, and his gantlet, with his royal mantle, his crown of gold, and crofs of silver, on the apostle's fepulchre. After this, he reconciled the pope with the exarch, who was thereupon received into the city, where he continued for some time, maintaining a friendly correspondence with the pope. At this time an impostor, taking the name of *Tiberius*, and pretending to be defended from the emperors, seduced a great many people in Tuscany, and was by them proclaimed emperor. The exarch resolved to march against him ; but as he had not sufficient forces to oppose the rebels, Gregory, who let no opportunity slip of obliging Leo, persuaded the Romans to attend the exarch in this expedition ; by which means the usurper being taken in a castle, his head was sent to the emperor, and the rebellion utterly suppressed. But the emperor still insisting upon his edict against the images being received in Rome, the Romans, at the instigation of the pope, publicly renounced their allegiance to Leo, paid him no more tribute, and withdrew for ever their obedience to the emperors of the East.

20 The emperor seizes the dominions of the pope. Leo, informed of this revolt, and not questioning but the pope was the author of it, immediately caused all the patrimonies of the church of Rome in Sicily, Calabria, and his other dominions, to be confiscated. At the same time, he ordered a powerful army to be raised, with a design to recover the towns that had revolted ; to chastise the Romans for their rebellion ; and, above all, to be revenged on the pope, who had raised all these disturbances, by opposing himself, and persuading others to oppose, the execution of his edict. Gregory, alarmed at the warlike preparations that were carrying on throughout the empire, and well apprised that they were chiefly designed against him and the Romans, resolved to recur to the protection of the French, the only nation at that time capable of coping with the emperor, and on whom, on account of their zeal for religion, he thought he might depend. The Lombards were then very powerful ; but, as they wanted to be masters of Rome, he did not think it advisable to trust them. The Venetians, though zealous in the defence of the pope, were not yet in a condition to withstand the power of the emperor ; and, besides, were jealous of the Lombards, who watched all opportunities of enlarging their dominions at the expence of their neighbours. As for Spain, it was then in a most deplorable condition, being over-run, and almost wholly ruined, by the Saracens.

21 Who supplies to the French. The French nation was at this time governed by the celebrated Charles Martel, who had distinguished himself in a most eminent manner in the wars of France and Germany ; and had, not long before, gained a signal victory over the Saracens in the neighbourhood of Tours ; whence he was generally reputed the best commander, and the greatest hero, of his time. To him, therefore, Gregory sent a solemn embassy, with a great number of relies, earnestly intreating him to take the Romans, and the church, under his protection, and defend them against the attempts of Leo. The ambassadors were received with

extraordinary marks of honour ; and a treaty was soon concluded between them and Charles, who engaged to march into Italy in person, at the head of a powerful army, in defence of the Romans and the church, if they should be attacked either by the emperor or the Lombards. On the other hand, the Romans were to acknowledge him for their protector, and confer on him the honour of the consulship, as it had been formerly conferred on Clovis by the emperor Anastasius, after that prince had defeated the Visigoths. The ambassadors returned from France loaded with rich presents. But Gregory did not long enjoy the fruit of their negotiations ; for he died the same year 731, and was succeeded by Gregory III. in whose time some place the above-mentioned embassy.

22 End of the Lombard monarchy. The French nation was at this time just recovered from its distressed situation under the descendants of Clovis ; and by the bravery and conduct of Charles Martel, had become the most powerful kingdom in the west. His successor Pepin was no less wise and powerful than his father had been ; and as the ambition of the Lombard princes would be satisfied with nothing less than the entire conquest of Italy, the French monarch, Charlemagne, under colour of assisting the pope, at last put an end to the empire of Lombardy, as related under the article FRANCE, n^o 21, 22.

23 Character of the Lombards. The Lombards were at first a cruel and barbarous nation ; but divesting themselves by degrees of their native fierceness and barbarity, especially after they had embraced the Christian religion, they governed with such equity and moderation, that most other nations envied the happiness of those who lived under them. Under the government of the Lombards (says Paulus Diaconus) no violence was committed, no one unjustly dispossessed of his property, none oppressed with taxes ; theft, robberies, murder, and adultery, were seldom heard of : every one went, without the least apprehension, wherever he pleased. Their laws were so just and equitable, that they were retained in Italy, and observed there some ages after their kingdom was at an end.—According to Paulus Diaconus, also, their dress was loose, and for the most part of linen, such as the Anglo-Saxons wore, being interwoven with various colours ; that their shoes were open to the end of their foot, and that they used to button or lace them. From some ancient paintings, it appears, that they shaved the back part of their heads, but that their hair was long before ; their locks being parted, and laid on each side their foreheads.

LOMBARD, or LOMBART (Peter), an engraver of considerable eminence, who flourished about the year 1660. He was a native of Paris, where he learned the art of engraving. It appears that he came into England before the revolution, because some of his plates for English publications are dated prior to that event. He executed a vast variety of plates, as well historical as emblematical ; which, however, were chiefly for books. But his best works are portraits ; and of these he produced a considerable number, which are esteemed. They are mostly after Vandyck.—He also engraved historical subjects, from Poussin, Raphael, Annibal Caracci, Guido, and other masters.

LOMENTACEÆ, in botany (from *lomentum*, a colour

Lombards

Lomentaceæ.

End of the Lombard monarchy.

Character of the Lombards.

Loch
Lomond

Lomond
zof.

colour used by painters), the name of the 33d order in Linnaeus's *Fragments of a Natural Method*, consisting of the following genera, many of which furnish beautiful tinctures that are used in dyeing, viz. *adenanthera*, *baubinia*, *caesalpinia*, *caffia*, *ceratonia*, *cercis*, *gleditria*, *guilandina*, *hamatoxylon*, *hymenaea*, *mimosa*, *parkinsonia*, *poinciana*, *polygama*. See BOTANY, p. 464.

LOCH-LOMOND, a large lake of Dunbarton or Lennox-shire in Scotland, of which Mr Pennant gives the following description. "Loch-lomond, the lust, the most beautiful of the Caledonian lakes. The first view of it from Tarbat presents an extensive serpentine winding amidst lofty hills; on the north, barren, black, and rocky, which darken with their shade that contracted part of the water. On the west side, the mountains are clothed near the bottoms with woods of oak quite to the water-edge; their summits lofty, naked, and craggy. On the east side, the mountains are equally high; but the tops form a more even ridge parallel to the lake, except where Ben-lomond, like Saul amidst his companions, overtops the rest. The upper parts were black and barren; the lower had great marks of fertility, or at least of industry, for the yellow corn was finely contrasted with the verdure of the groves intermixed with it.

"This eastern boundary is part of the Grampian hills, which extend from hence through the counties of Perth, Angus, Mearns, and Aberdeen. The road runs sometimes through woods, at others is exposed and naked; in some, so steep as to require the support of a wall; the whole the work of the soldiery: blessed exchange of instruments of destruction for those that give safety to the traveller, and a polish to the once inaccessible native! Two great head-lands covered with trees separate the first scene from one totally different; the last is called the *Point of Firkin*. On passing this cape an expanse of water bursts at once on your eye, varied with all the softer beauties of nature. Immediately beneath is a flat covered with wood and corn; beyond, the headlands stretch far into the water, and consist of gentle ridings; many have their surfaces covered with wood, others adorned with trees loosely scattered either over a fine verdure or the purple bloom of the heath. Numbers of islands are dispersed over the lake, of the same elevated form as the little capes, and wooded in the same manner; others just peep above the surface, and are tufted with trees; and numbers are so disposed as to form magnificent vistas between.

"Opposite Lufs, at a small distance from shore, is a mountainous isle almost covered with wood; is near half a mile long, and has a most fine effect. I could not count the number of islands, but was told there are 28; the largest two miles long, and stocked with deer.

"The length of this charming lake is 24 Scotch miles; its greatest breadth 8; its greatest depth, which is between the point of Firkin and Ben-lomond, is 120 fathoms. Besides the fish common to the lochs are guinaiads, called here *poans*.

"The surface of Loch-lomond has for several years past been observed gradually to increase, and invade the adjacent shore: and there is reason to suppose that churches, houses, and other buildings, have been lost

in the water. Near Lufs is a large heap of stones at a distance from the shore, known by the name of the old church; and about a mile to the south of that, in the middle of a large bay, between Camitradan and the isle Inch-lavanack, is another heap, said to have been the ruins of a house. To confirm this, it is evident by a passage in Camden's *Atlas Britannica*, that an island, existing in his time, is now lost; for he speaks of the isle of Camitradan, placed between the lands of the same name and Inch-lavanack, in which, adds he, was an house and orchard. Besides this proof, large trees with their branches still adhering are frequently found in the mud near the shore, overwhelmed in former times by the increase of water. This is supposed to be occasioned by the vast quantities of stone and gravel that are continually brought down by the mountain rivers, and by the falls of the banks of the Leven; the silt filling the bed of the lake, the silt impeding its discharge through the bed of the river."

LOMONOZOF, a celebrated Russian poet, the great refiner of his native tongue, was the son of a person who trafficked in fish at Kolmogori: he was born in 1711, and was fortunately taught to read; a rare instance for a person of so low a station in Russia. His natural genius for poetry was first kindled by the perusal of the Song of Solomon, done into verse by Polotki, whose rude composition, perhaps scarcely superior to our version of the psalms by Sternhold and Hopkins, inspired him with such an irresistible passion for the muses, that he fled from his father, who was desirous of compelling him to marry, and took refuge in the Kaikonoispalski monastery at Moscow; there he had an opportunity of indulging his taste for letters, and of studying the Greek and Latin languages. In this seminary he made so considerable a progress in polite literature, as to be noticed and employed by the Imperial academy of sciences. In 1736 he was sent at the expense of that society, to the university of Marburgh in Hesse Cassel, where he became a scholar of the celebrated Christian Wolf, under whom he studied universal grammar, rhetoric, and philosophy. He continued at Marburgh four years, during which time he applied himself with indefatigable diligence to chemistry, which he afterwards pursued with still greater success under the famous Henckel at Freyberg in Saxony. In 1741 he returned into Russia; was chosen in 1742 adjunct to the imperial academy; and in the ensuing year member of that society and professor of chemistry. In 1760 he was appointed inspector of the seminary, then annexed to the academy; in 1764 he was gratified by the present empress with the title of counsellor of state; and died April 4th that year, in the 54th year of his age. Lomonozof excelled in various kinds of composition; but his chief merit, by which he bears the first rank among the Russian writers, is derived from his poetical compositions, the finest of which are his odes. The first was written in 1739, while he studied in Germany, upon the taking of Kotlichin, a fortress of Crim. Tartary, by Marshal Munich. The odes of Lomonozof are greatly admired for originality of invention, sublimity of sentiment, and energy of language; and compensate for the turpid style which, in some instances, have been imputed to them, by that spirit and fire which are the prin-

Lomonozof,
London.

principal characteristics in this species of composition. Pindar was his great model; and if we may give credit to a person well versed in the Russian tongue, he has succeeded in this daring attempt to imitate the Theban bard, without incurring the censure of Horace. In this, as well as several other species of composition, he enriched his native language with various kinds of metre, and seems to have merited the appellation bestowed upon him of the *Father of Russian Poetry*. A brief recapitulation of the principal works of Lomonozof, which were printed in three volumes octavo, will serve to show the versatility of his genius, and his extensive knowledge in various branches of literature. The first volume, beside a Preface on the advantages derived to the Russian tongue from the ecclesiastical writings, contains ten sacred and nineteen panegyric odes, and several occasional pieces of poetry. The second comprises An Essay in Prose on the Rules for Russian Poetry; Translation of a German Ode; Idylls; Tamira and Selim, a tragedy; Demophoon, a tragedy; Poetical Epistle on the Utility of Glais; two cantos of an epic poem, intitled, Peter the Great; A Congratulatory Copy of Verses; An Ode; Translation of Baptiste Rousseau's Ode *Sur le Bonheur*; Heads of a Course of Lectures on Natural Philosophy; certain passages translated in verse and prose, according to the original, from Cicero, Erasmus, Lucian, Elian, Ammianus Marcellinus, Quintus Curtius, Homer, Virgil, Martial, Ovid, Horace, and Seneca, which Russian translations were brought as examples in his Lectures upon Rhetoric; lastly, Description of the Comet which appeared in 1744. The third volume consists chiefly of Speeches and Treatises read before the Academy; Panegyric on the Empress Elizabeth; on Peter the Great; Treatise on the Advantages of Chemistry; on the Phenomena of the Air occasioned by the Electrical Fire, with a Latin translation of the same; on the Origin of Light as a new Theory of Colours; Methods to determine with precision the Course of a Vessel; on the Origin of Metals by the means of Earthquakes; Latin Dissertation on Solidity and Fluidity; on the Transit of Venus in 1761, with a German translation. Beside these various subjects, Lomonozof made no inconsiderable figure in history, having published two small works relative to that of his own country. The first, styled Annals of the Russian Sovereigns, is a short chronology of the Russian monarchs; and the second is, the Ancient History of Russia, from the Origin of that Nation to the Death of the Great Duke Yaroslav I. in 1054; a performance of great merit, as it illustrates the most difficult and obscure period in the annals of this country.

LONDON, a large city of Middlesex in England, the metropolis of Great Britain, and one of the most wealthy and populous places in the world, is situated on the river Thames, in 51° 31' north latitude, 400 miles south of Edinburgh, and 270 south-east of Dublin; 180 miles west of Amsterdam, 210 north-west of Paris, 500 south-west of Copenhagen, 600 north-west of Vienna, 790 south-west of Stockholm, 800 north-east of Madrid, 820 north-west of Rome, 850 north-east of Lisbon, 1360 north-west of Constantinople, and 1414 south-west of Moscow.

This city was by the Romans first called *Londinium* or *Lundinium*, as we find it in Tacitus, Ptolemy, An-
N° 186.

London.

toninus, and Ammianus. That name was afterwards changed into *Agylla* in honour, as some say, of Helena Augusta, the mother of Constantine the Great; while others think it more probable that it had this name from the second legion, whose peculiar title was *Augusta*; and some imagine that the honourable appellation of *Augusta* was conferred upon this city by the Romans, as upon other principal cities of their empire, on account of its being grown up to be the capital of their British province. How long the name of *Augusta* prevailed, is not now certainly known; but after the establishment of the Saxons we find no more mention of *Augusta*. It was then called *Caer Lundain*, *Lundon Byrig*, *Lunden Caester*, *Lunden-zyge*, *Lundenne*, *Lunden-berb*, or *Lundenburg*; since the conquest the records call it *Londinia*, *Lundonia*, *Londine*, *Londres*; and, for several ages past, it has been called *London*, a manifest corruption from Tacitus's *Londinium*. The most probable derivation of these names appears to be, either from the British words *llong* "a ship," and *din* "a town," i. e. a town or harbour for ships; or from *Llin* "a lake," i. e. *Llin din*, "the town upon the lake," the Surry side being supposed, upon very probable grounds, to have been anciently a great expanse of water.

Londinium, however, was not the primitive name of this famous place, which existed before the invasion of the Romans; being, at the time of Caesar's arrival in the island, the capital of the *Trinobantes* or *Trinou-ats*. The name of this nation, as appears from Baxter's British Glossary, was derived from the three following British words, *tri*, *nou*, *bant*, which signify the "inhabitants of the new city." This name, it is supposed, might have been given them by their neighbours, on account of their having newly come from the continent into Britain, and having there founded a city called *tri-nou*, or the "new city;" the most ancient name of the renowned metropolis of Britain. The *Trinobantes* had come so lately from Belgium, that they seem scarcely to have been firmly established in Britain at the time of the first Roman invasion: For their new city, which soon after became so famous, was then so inconsiderable, that it is not mentioned by Caesar, tho' he must have been within sight of the place where it was situated. His silence about this place, indeed, is brought as a proof that he did not cross the Thames; while Norden by the *firmissima civitas* of the *Trinobantes* understands the city in question the *Trinobantes* themselves having been among the first of the British states who submitted to that conqueror.

By Ptolemy, and some other ancient writers of good authority, indeed, *Londinium* is placed in Cantium, or Cent, on the fourth side of the Thames; and it is the opinion of some moderns, that the Romans probably had a station there, to secure their conquests on that side of the river, before they reduced the *Trinobantes*. The place fixed upon for this station is St George's field, a large plot of ground situated between Lambeth and Southwark, where many Roman coins, bricks, and chequered pavements, have been found. Three Roman ways from Kent, Surry, and Middlesex, intersected each other in this place: this therefore is supposed to be the original *Londinum*, which it is thought became neglected after the Romans reduced the *Trinobantes*, and settled on the other
3 side

When founded.

† p. 238

Henry's Hist. vol. 5. p. 170.

² London. side of the Thames; and the name was transferred to the new city.

The situation of this city, as Mr Pennant observes, was just such as the people would select according to the rule established among the Britons. An immense forest originally extended to the river-side, and even as late as the reign of Henry II. covered the northern neighbourhood of the city, and was filled with various species of beasts of chase. It was defended naturally by fosses; one formed by the creek which run along Fleet-ditch, the other afterwards known by that of Walbrook; the south side was guarded by the Thames; the north they might think sufficiently protected by the adjacent forest.

³ When taken possession of by the Romans.

The Romans possessed themselves of London, on their second invasion in the reign of Claudius, about 105 years after their first under Cæsar. They had begun with Camalodunum, the present Maldon in Essex; and having taken it, planted there a colony consisting of veterans of the 14th legion. London and Verulam were next taken possession of about one and the same time. Camalodunum was made a *colonia*, or place governed entirely by Roman laws and customs; Verulam (on the site of which St Alban's now stands), a *municipium*, in which the natives were honoured with the privileges of Roman citizens, and enjoyed their own laws and constitutions; and Londinium only a *prefectura*, the inhabitants, a mixture of Romans and Britons, being suffered to enjoy no more than the name of citizens of Rome, being governed by Prefects sent annually from thence, without having either their own laws or magistrates. "It was even then of such concourse (says Mr Pennant), and such vast trade, that the wise conquerors did not think fit to trust the inhabitants with the same privileges as other places of which they had less reason to be jealous." But others observe, that this is a mistake; and that the Romans, in order to secure their conquest, and to gain the affections of those Britons who had already submitted to their authority, made London equally a *municipium* or free city with Verulamium, as may be seen by referring to Aulus Gellius, l. 16. c. 13. and to Spanhem. orbis Roman. p. 37, 38. tom. ii.

⁴ Ancient commerce of London.

It is difficult to say what were the particular articles of commerce exported from and imported into the port of London at this period. The imports and exports of the island in general we know: Strabo says, "Britain produceth corn, cattle, gold, silver, iron; besides which, skins, slaves, and dogs naturally excellent hunters, are exported from that island." It is probable that the two first and three last articles were exported from London; and perhaps, too, the *gagates* or jet-stone mentioned by Solinus as one of the productions of Britain, together with horses, were exported from thence. The imports were at first salt, earthen ware, and works in brass, polished bits of bones emulating ivory, horse-collars, toys of amber, glasses, and other articles of the same material.

In the reign of Nero, as Tacitus informs us, London was become a city highly famous for the great conflux of merchants, her extensive commerce, and plenty of all things. No fewer than seven of the fourteen itinera of Antoninus begin or end at London; which tends to corroborate the many proofs

which might be adduced, that this city was the capital of Britain in the Roman times.

At first London had no walls or other fortifications ⁵ when first to defend it, and was therefore exposed to the attacks of every enemy, and thus it suffered severely about the year 64, being burnt by the Britons under Boadicea, and all the inhabitants massacred. But it was soon restored by the Romans; and increased so much, that in the reign of the emperor Severus it is called by Herodian a *great and wealthy city*. It continued, however, in a defenceless state for more than a century after this last period; when at last a wall of hewn stone and British bricks was erected round it.

London at this time extended in length from Ludgate-hill to a spot a little beyond the Tower. The breadth was not half equal to the length, and at each end grew considerably narrower. Maitland ascribes the building of the walls to Theodosius governor of Britain in 369. Dr Woodward, with more probability, supposes them to have been founded under the auspices of Constantine the Great; and this seems to be confirmed by the numbers of coins of that emperor's mother Helena, which have been discovered under them, placed there by him in compliment to her. The same emperor made it a bishop's see; for it appears that the bishops of London and York, and another English bishop, were at the council of Ailes in the year 314; he also settled a mint in it, as is plain from some of his coins. The ancient course of the wall was as follows: It began with a fort near the present site of the Tower, was continued along the Minories, and the back of Houndditch, across Bishopgate-street, in a straight line by London-wall to Cripple-gate; then returned southward by Crowder's Well Alley, (where several remnants of lofty towers were lately to be seen) to Aldersgate; thence along the back of Bull and Mouth-street to Newgate, and again along the back of the houses in the Old Bailey to Ludgate; soon after which it probably finished with another fort, where the house, late the king's printing house, in Black Friars, now stands: from hence another wall ran near the river side, along Thames-street, quite to the fort on the eastern extremity. The walls were three miles a hundred and sixty-five feet in circumference, guarded at proper distances on the land side with fifteen lofty towers; some of them were remaining within these few years, and possibly may still Maitland mentions one twenty-six feet high, near Gravel-lane, on the west side of Houndditch; another, about eighty paces south-east towards Aldgate; and the bases of another, supporting a modern house, at the lower end of the street called the Vineyard, south of Aldgate. The walls, when perfect, are supposed to have been twenty-two feet high, the towers forty. These, with the remnants of the wall, proved the Roman structure, by the tiles and disposition of the masonry. London-wall, near Moorfields, is now the most entire part left of that ancient precinct. The gates, which received the great military roads, were four. The Prætorian way, the Saxon Watling street, passed under one, on the site of the late Newgate; vestiges having been discovered of the road in digging above Holburn-bridge: it turned down to Dowgate, or more properly Dwr-gate or Water-gate, where

⁶ Their ancient course, &c.

^{London,} there was a trajectus or ferry, to join it to the Watling-street, which was continued to Dover. The Hermin street passed under Cripplegate; and a vicinal way went under Aldgate by Bethnal-green, towards Oldford, a pafs over the river Lee to Duroleiton, the modern Leiton in Effex.

^{London} After the Romans deferred Britain, a new and fierce race fucceeded. The Saxons, under their leaders Hengist and Horsa, landed in 448, having been invited over by the provincials as auxiliaries against the Scots and Picts; but quarrelling with their friends, they found means to establish themselves in the island, and in procefs of time entirely subdued them, as related under the article ENGLAND, n° 31—44. ^{London} fell into the hands of those invaders about the year 457; and became the chief city of the Saxon kingdom in Effex. It suffered much in the wars carried on between the Britons and Saxons: but it soon recovered; so that Bede calls it a *princely mart-town*, under the government of a chief magistrate, whose title of *portgrave*, or *portreeve* (for we find him called by both names), conveys a grand idea of the mercantile state of London in those early ages, that required a governor or guardian of the port. During the civil wars of the Saxons with each other, the Londoners had always the address to keep themselves neuter; and about the year 819, when all the seven Saxon kingdoms fell under the power of Egbert, London became the metropolis of England, which it has ever since continued.

^{Plundered by the Danes.} During the invasions of the Danes, London suffered greatly. In 849, these invaders entered the Thames with 250 ships, plundered and burnt the city, and massacred the inhabitants; and two years after they returned with a fleet of 350 sail, fully determined to destroy every thing that had escaped their barbarity in the former expedition. At this time, however, they were disappointed; most of their troops being cut in pieces by king Ethelwolf and his son Athelbald; yet such was the destruction made by those barbarians at London, that it suffered more from these two incursions than ever it had done before.

^{Recovers under Alfred the Great.} In the reign of king Alfred the Great, London began to recover from its former ruinous state. He rebuilt its walls, drove out the Danish inhabitants who had settled there, restored the city to its former liberties and beauty, and committed the care of it to his son-in-law, Elthelred duke of Mercia, in hopes that this might always be a place of secure retreat within its strong walls, whatever might happen from a foreign or domestic enemy. In 893, however, he had the mortification to see his capital totally reduced to ashes by an accidental fire, which could not be extinguished, as the houses at that time were all built of wood. The walls, however, being constructed of incombustible materials, continued to afford the same protection as before; the houses were quickly rebuilt, and the city divided into wards and precincts for its better order and government. This king also instituted the office of sheriff, the nature of which office made it necessary to have it also in London: so that here we have the glimmerings of the order of magistrates afterwards settled in the city of London; in the person of the portreeve, or portgrave, or governor of the city, as supreme magistrate; in the sheriff, and in the officer or subordi-

^{London,} nate magistrate by what name soever then distinguished, which, being placed at the head of each ward or precinct, were analogous to the more modern title of *aldermen* and *common-council men*.

^{Brick and stone houses first erected.} Alfred having settled the affairs of England in the most prudent manner, directed his attention to the ornamenting, as much as possible, the city of London. For this purpose, he spirited up the English to an emulation in building their houses of stronger and more durable materials than formerly. At that time their houses were mostly of wood; and an house built of any other materials was looked upon as a kind of wonder. But Alfred having begun to raise his palaces of stone and brick, the opulent Londoners, and the nobility resident in and about London, followed the example, though the custom did not come into general use till some ages after.

^{Defeated by Canute.} In 1015, a foreign enemy again appeared before London. Canute king of Denmark having invaded and plundered the counties of Dorset, Somerset, and Wilts, sailed up the Thames with 200 ships, and laid siege to the city. The citizens continued faithful, notwithstanding the defection of the greatest part of the kingdom; and made such a brave resistance, that Canute thought fit to withdraw his army, leaving only his fleet to blockade the city by water, that when he found a fair opportunity he might renew the siege with better success. At last, however, being defeated in several battles by Edmund Ironside, he was obliged to call off his ships to cover his own army in case of necessity. In the compromise, however, which was afterwards made between Edmund and Canute, the city of London was given to the latter, and owned him for its lawful sovereign. We have a strong proof of the opulence of London even at this time, from the tax laid upon it by Canute in order to pay his army; this being no less than 105,000 l. while the rest of the nation was at the same time taxed only at 72,000 l.

^{Sends representatives to parliament.} In 1046, we have the first instance of the Londoners sending representatives to parliament. This happened on settling the succession to the throne after Canute's death. The English in general declared for Edward son of king Ethelred; or, if that could not be carried, for Hardicanute, son of Canute by queen Emma, and then absent on a tour to Denmark. The city of London espoused the claim and interest of Harold Harefoot, son also of Canute, by queen Elgiva of Northampton. Edward's party soon declined; and the Londoners agreed, for the peace of the realm, that the two brothers should divide the kingdom between them; but as Hardicanute did not return in proper time to England, a *witnensage-mote* was held at Oxford, where earl Leofrie, and most of the thanes on the north of the Thames, with the pilots of London, chose Harold for their king. Here, by pilots we are to understand the directors, magistrates, or leading men of the city: and this manifestly shows, that London was then of such consequence, that no important national affair was transacted without the consent of the inhabitants; for the Saxon annals assure us, that none were admitted into this assembly of election but the nobility and the pilots of London.

^{Suffers greatly by fires, hurricanes, &c.} On the invasion of the Normans under William I. London submitted as well as the rest of the kingdom; and received two charters from that prince, confirming

London. ing all the privileges they had under the Saxon kings, and adding several new ones. But while the citizens were promising themselves all manner of security and tranquillity under the new government, it was almost entirely reduced to ashes by an accidental fire in 1077. It had scarcely recovered from this calamity, when it was visited by another of the same kind in 1086, which began at Ludgate, and destroyed the best and most opulent part of the city; consuming, among other buildings, the cathedral of St Paul's; which, however, was soon rebuilt more magnificently than before. Under the reign of William Rufus, London suffered considerably by fires, hurricanes, and inundations, and seems to have been depressed by the tyranny of that prince; but Henry I. granted large immunities to the city, which again revived its trade, and was favourable to the progress of the arts. The king, however, still retained the privilege of appointing the portreeve, or chief magistrate; but the immunities granted to the Londoners secured their affections, and tended much to secure him on the throne. At the same time, there was such a plenty of all kinds of provisions, that as much corn was sold for 1s. as would suffice 100 people for a day; 4d. would purchase as much hay and corn as would maintain 20 horses for a day; and a sheep could be bought for a groat.

26
Monstrous
licentious-
ness of the
Normans.

Henry thought proper also to check the licentious behaviour of the Normans, which, by the favour showed them under the two Williams, had carried them into the most barbarous practices. Those who followed William Rufus in his excursions, harassed and plundered the country at discretion. Many of them were so extravagant in their barbarity, that what they could not eat or drink in their quarters, they either obliged the people to carry to market and sell for their use, or else they would throw it into the fire: and, at their going off, they frequently washed their horses heels with the drink, and flaved the calks containing the remainder. King Henry resolved to put a stop to these excesses and savage customs; and therefore published a proclamation at London, commanding that thenceforward all persons who should be convicted of such barbarities should have their eyes pulled out, or their hands or feet cut off, as the ministers of justice should think fit. This effectually checked the insolence of the Normans, and the city continued to flourish throughout the reigns of Henry I. and Stephen. The attachment of the citizens to Stephen, however, was a crime which never could be forgiven by Henry II. and, of consequence, he made them sensible of his displeasure, by making frequent demands of money from them. About this time, indeed, the Londoners were arrived at such a pitch of licentiousness, that their prosperity seemed a curse rather than a blessing. The sons of the most eminent and wealthy citizens entered into a confederacy to commit burglaries, and to rob and murder all that came in their way in the night-time. The king took an opportunity from these irregularities to enrich himself. He demanded several loans and free gifts; till at last the Londoners, to prevent further inquiries into their conduct, paid into the exchequer 5000l. in three years. These disorders, however, were at last stopped by the execution of John Senex; who, though a very rich and reputable citizen,

17
of the
Londoners.

had engaged in these enterprizes. He offered 500 lb. weight of silver, a prodigious sum in those days, for his pardon, but was refused. The king, however, still continued to drain the citizens of their money by free gifts; and at last fined every separate guild, fraternity, or company, that had presumed to act as bodies corporate without the royal letters-patent.

On the death of Henry II. the title of the first magistrate of London was changed from *portreeve* to that of *baillif*; and in 1189 claimed and acted in the office of the *chief bailif* at the coronation of Richard I. In 1191 this monarch permitted the bailiff, named *Henry Fitz Aulvine*, to assume the title of *mayor*. For, in 1192, we find certain orders of the mayor and aldermen to prevent fires; whereby it was ordained, that "all houses thereafter to be erected in London and the liberties thereof, should be built of stone, with party-walls of the same; and covered either with slates or tiles, to prevent those dreadful calamities by fire, which were frequently and chiefly occasioned by houses built of wood, and thatched with straw or reeds." And for this purpose, it was also provided by the discreeter men of the city, "that 12 aldermen of the city should be chosen in full hustings, and there sworn to assist the mayor in appeasing contentions that might arise among neighbours in the city upon inclosure betwixt land and land, and to regulate the dimensions of party-walls, which were to be of stone, 16 feet high and three feet thick; and to give directions about girders, windows, gutters, and wells." Such confidence also did Richard put in the wisdom and faithfulness of the city of London, that when it was resolved to fix a standard for weights and measures for the whole realm, his majesty committed the execution thereof to the sheriffs of London and Middlesex, whom he commanded to provide measures, gallons, iron rods, and weights for standards, to be sent to the several counties of England. This happened in 1193, at which time corn was advanced to the enormous price of 18s. 4d. per quarter.

The city of London was much favoured by King John, who granted them three charters soon after his accession. The first was a recital and confirmation of the privileges granted by Henry I. and II. with the farther privilege of being free from toll and every other duty or custom in his majesty's foreign dominions; for which they paid the sum of 3000 mēks. The second was a confirmation of one granted by King Richard. By this the citizens of London had the jurisdiction and conservancy of the river Thames; with a clause to extend that jurisdiction, and the powers therewith granted, to the river Medway; and with another clause to enable the said city, as conservators of the rivers Thames and Medway, to inflict a penalty of 10l. upon any person that should presume to erect a wear in either of these rivers. The third charter contains a fee-farm-rent of the sheriffwicks of London and Middlesex at the ancient rent, of which they had been deprived by Queen Maud; granting them also the additional power of choosing their own sheriffs. This charter was given by way of conveyance from the crown to the citizens for a valuable consideration, by which the sheriffwick became their freehold; and this is the first covenant or conveyance we find on record

London.

18
The office
of mayor,
when first
instituted.

19
Favours
granted to
the city by
King John.

London.

with the legal terms of *to have and to hold*, which are at this time accounted an essential part in all conveyances of property.

20
London op-
pressed by
Henry III.

During the reign of Henry III. the city of London was oppressed in many different ways. In 1218, he exacted a fine of 40 marks for selling a sort of cloth not two yards within the lints; and a 15th of the citizens personal estates for the enjoyment of their ancient rights and privileges. In 1221, he commanded by proclamation all the foreign merchants to depart the city; which drew 30 marks from the Anseatic company of the *Steelhard*, to have seisin of their guild or hall in Thames-street. But it was the wrestling-match at St Giles's in the fields that brought on their greatest burden. In the year 1221, on St James's day, the citizens of London having carried off the victory from the people of Westminster and other neighbouring villages, the steward of the abbot of Westminster, meditating revenge against the Londoners, proposed another wrestling-match with them, and gave a rain for the prize. The citizens resorted to the place at the time appointed; but were unexpectedly assaulted by a great number of armed men, who killed and wounded many, and dispersed the rest. This raised a great commotion in the city. The populace breathed revenge; and, by the instigation of Constantine Fitz-Arnuolph, a great favourite of the French party during the troubles in king John's reign, they proceeded to Westminster, and pulled down the houses both of the steward and abbot. Hearing afterwards that the abbot was come into the city with his complaint to Philip Daubney the king's counsellor, they pursued him, beat his servants cruelly, took away 12 of his horses, and would have murdered himself, had he not escaped by a back-door. Upon this tumult, Hubert de Bury, then chief justiciary, summoned the mayor and many of the principal citizens to attend him in the tower of London; and inquiring for the authors of the riot, Constantine, the ringleader, boldly answered, that "he was one; that they had done no more than they ought; and that they were resolved to avow what they had done, let the consequence be what it would." In this he was seconded by his nephew and one Geoffrey; but the justiciary, having dismissed all the rest, detained these three, and ordered them to be hanged next morning, though Constantine offered 15,000 marks for his pardon. Hubert then coming into the city with a strong guard, caused the hands and feet of most of the principal rioters he could seize to be cut off: all which was executed without any legal proceedings or form of trial. After these arbitrary cruelties, he degraded the mayor and all the magistrates; placed a *custos* over the city, and obliged 30 persons of his own choosing to become securities for the good behaviour of the whole city. Several thousand marks were also exacted by the king, before he would consent to a reconciliation.

This arbitrary behaviour alarmed the whole nation. The parliament of 1224 began to be uneasy for themselves, and addressed his majesty that he would be pleased to confirm the charter of liberties which he had sworn to observe; and the consequence of this application was a confirmation of the magna charta in the full parliament at Westminster in the year 1225. At this time also, the rights and privileges of the citizens

were confirmed. They were exempted from prosecutions for burles, *i. e.* lifted cloth; and were granted the right of having a common seal. The necessitous circumstances of this monarch, however, made him often exact money arbitrarily as long as he lived.

Under the succeeding reigns, as the liberty of the people in general was augmented, so the liberty, opulence, and power of the citizens of London increased, until they became a kind of balance to the power of the crown itself, which in some measure they still continue to be. Riots indeed, for which they generally suffered, were by no means unfrequent; the city often suffered by fires and plagues. Nothing, however, happened which materially affected the welfare of the city, till the reign of Charles II. in 1665.—This year London was ravaged by the most violent plague ever known in Britain. Dreadful
The whole summer had been remarkably still and plague in warm, so that the weather was sometimes suffocating,¹⁶⁶⁵⁻ even to people in perfect health; and by this unusual heat and sultry atmosphere, people were undoubtedly prepared for receiving the infection, which appeared with violence in the months of July, August, and September. A violent plague had raged in Holland in the year 1663; on which account the importation of merchandise from that country was prohibited by the British legislature in 1664. Notwithstanding this prohibition, however, it seems the plague had actually been imported; for in the close of the year 1664, two or three persons died suddenly in Westminster, with marks of the plague on their bodies. Some of their neighbours, terrified at the thoughts of their danger, removed into the city; but their removal proved too late for themselves, and fatal to those among whom they came to reside. They soon died of the plague; and communicated the infection to so many others, that it became impossible to extinguish the seeds of it by separating those that were infected from such as were not. It was confined, however, through a hard frosty winter, till the middle of February, when it again appeared in the parish of St Giles's, to which it had been originally brought; and after another long rest till April, showed its malignant force afresh, as soon as the warmth of the spring gave it opportunity.—At first, it took off one here and there, without any certain proof of their having infected each other, and houses began to be shut up, with a design to prevent its spreading. But it was now too late; the infection gained ground every day, and the shutting up of houses only made the diseases spread wider. People, afraid of being shut up, and sequestered from all communications with society, concealed their illness, or found means to escape from their places of confinement; while numbers expired in the greatest torments, destitute of every assistance; and many died both of the plague and other diseases, who would in all probability have recovered, had they been allowed their liberty, with proper exercise and air.—A house was shut up on account of a maid-servant, who had only spots, and not the gangrenous plague-blotches, upon her, so that her distemper was probably a petechial fever. She recovered; but the people of the house obtained no liberty to stir, either for air or exercise, for 40 days. The bad air, fear, anger, and vexation, attending this injurious treatment, cast the mistress of the family into a fever. The visitors appointed to
search

London.

London. search the houses, said it was the plague, though the physicians were of a different opinion: the family, however, were obliged to begin their quarantine anew, though it had been almost expired before; and this second confinement affected them so much, that most of the family fell sick, some of one distemper and some of another. Every illness that appeared in the family produced a fresh prolongation of their confinement; till at last the plague was actually brought in by some of those who came to inquire into the health of the family, and almost every person in the house died.—Many examples of a similar kind happened, and this was one of the worst consequences of shutting up houses. All means of putting a stop to the infection were evidently ineffectual. Multitudes fled into the country; many merchants, owners of ships, &c. shut themselves up, on board their vessels, being supplied with provisions from Greenwich, Woolwich, and single farm-houses on the Kentish side. Here, however, they were safe; for the infection never reached below Deptford, though the people went frequently on shore to the country-towns, villages, and farm-houses, to buy fresh provisions. As the violence of the plague increased, the ships which had families on board removed farther off; some went quite out to sea, and then put into such harbours and roads as they could best get at.

In the mean time, the distemper made the most rapid advances within the city. In the last week of July, the number of burials amounted to 2010; but the first week of August it rose to 3817; thence to 3880; then to 4237; the next week, to 6102; and at last to 7000 and 8000 weekly. In the last week of September, however, the fury of the disease began to abate; though vast numbers were sick, yet the number of burials decreased from 7155 to 5538; the next week there was a farther decrease to 4929, then to 4327, next to 2665, then to 1421, and the next week to 1031.

All this while, the poor people had been reduced to the greatest distresses, by reason of the stagnation of trade, and the sicknesses to which they were peculiarly liable on account of their manner of living. The rich, however, contributed to their subsistence in a most liberal manner. The sums collected on this occasion, are indeed almost incredible; being said to amount to 100,000*l.* per week. The king is reported to have contributed 1000*l.* weekly; and in the parish of Cripple-gate alone 17,000*l.* was distributed weekly among the poor inhabitants.—By the vigilance also of the magistrates, provisions continued remarkably cheap throughout the whole time of this dreadful calamity, so that all riots and tumults on that account were prevented; and at last, on the cessation of the disease in the winter of 1665, the inhabitants who had fled returned to their habitations, and London to appearance became as populous as ever, though it was computed that 100,000 persons had been carried off by the plague.

22
Account of
the great
Sic in 1666.

The city was scarcely recovered from the desolation occasioned by the plague, when it was almost totally laid in ashes by a most dreadful fire. This broke out in a baker's shop in Pudding-lane, on Saturday-night, September 2. 1666. In a few hours Billingsgate ward was entirely burnt down; and before morning the fire had crossed Thames-street, and destroyed the church of St

Magnus. From thence it proceeded to the bridge, and consumed a great pile of buildings there; but was stopped by the want of any thing more to destroy. The flames, however, being scattered by a strong east wind, continued their devastations in other quarters. All efforts to stop it proved unsuccessful throughout the Sunday. That day it proceeded up as far as Garlick-hitch; and destroying Canon-street, invaded Cornhill and the exchange. On Monday, the flames having proceeded eastward against the wind through Thames-street, invaded Tower-street, Grace-church-street, Fenchurch-street, Dowgate, Old-fish-street, Watling-street, Thread-needle-street, and several others, from all which it broke at once into Cheap-side. In a few hours Cheap-side was all in flames, the fire having reached it from so many places at once. The fire then continuing its course from the river on one side, and from Cheap-side on the other, surrounded the cathedral of St Paul's. This building stood by itself at some distance from any houses; yet such was the violence of the flames, and the heat of the atmosphere occasioned by them, that the cathedral took fire at top. The great beams and masonry stones broke through into Faith-church underneath, which was quickly set on fire; after which, the flames invaded Pater-noster-row, Newgate-street, the Old Bailey, Ludgate-hill, Fleet-street, Iron-monger-lane, Old-jury, Laurence-lane, Milk-street, Wood-street, Cutler-lane, Foster-lane, Lothbury, Cateaton-street; and, having destroyed Christ-church, burnt furiously through St Martin's Le Grand towards Aldersgate.

The fire had now attained its greatest extent, and was several miles in compass. The vast clouds of smoke obscured the sun so, that he either could not be seen at all, or appeared through it as red as blood. The flames reached an immense way up into the air, and their reflection from the smoke, which in the night-time seemed also like flame, made the appearance still more terrible. The atmosphere was illuminated to a great extent, and this illumination is said to have been visible as far as Jedburgh in Scotland. Some of the light ashes also are said to have been carried to the distance of 16 miles. Guildhall exhibited a singular appearance. The oak with which it was built was so solid that it would not flame, but burnt like charcoal, so that the building appeared for several hours like an enchanted palace of gold or burnished brass.

At last, on Wednesday morning, when every one expected that the suburbs as well as the city were to have been burnt, the fire began of itself to abate by reason of the wind having ceased, and some other changes no doubt taken place in the atmosphere. It was checked by the great building in Leaden-hall-street, and in other streets by the blowing up several houses with gun-powder; and on Thursday the flames were quite extinguished.—The following is a calculation of the damage done by this extraordinary conflagration.

	<i>£.</i>	<i>s.</i>	<i>d.</i>	Calculation of the damage done
Thirteen thousand two hundred houses, at 12 years purchase, supposing the rent of each 25 <i>l.</i> Sterling,	3,960,000	0	0	
Eighty-seven parish-churches, at 8000 <i>l.</i>	696,000	0	0	
carried forward	4,656,000	0	0	

London.

brought over L.	4,656,000	0	0
Six consecrated chapels, at 2000l.	12,000	0	0
The royal exchange	50,000	0	0
The custom-house	10,000	0	0
Fifty-two halls of companies, at 1500l. each.	78,000	0	0
Three city-gates at 3000l. each	9000	0	0
Jail of Newgate	15,000	0	0
Four stone-bridges	6000	0	0
Sessions-house	7000	0	0
Guildhall, with the courts and offices belonging to it	40,000	0	0
Blackwell-hall	3000	0	0
Bridewell	5000	0	0
Poultry Compter	5000	0	0
Woodstreet Compter	3000	0	0
St Paul's church	2,000,000	0	0
Wares, household-stuff, money, and moveable-goods lost or spoiled	2,000,000	0	0
Hire of porters, carts, waggon, barges, boats, &c. for removing goods	200,000	0	0
Printed books and paper in shops and warehouses	150,000	0	0
Wine, tobacco, sugar, &c. of which the town was at that time very full	1,500,000	0	0
	10,689,000	0	0

It was never certainly known whether this fire was accidental or designed. A suspicion fell upon the Papists; and this gained such general credit, that it is ascribed for a truth on the monument which is erected in memory of the conflagration. Of the truth of this assertion, however, though there was not sufficient proof, it had the effect of making the Papists most violently suspected and abhorred by the Protestants, which some time after proved very prejudicial to the city itself.

From this calamity, great as it was, London soon recovered itself, and became much more magnificent than before; the streets, which were formerly crooked and narrow, being now built wide and spacious; and the industry of its inhabitants repaired the losses they had sustained. In 1679, the city was again alarmed by the discovery of a design to destroy it by fire a second time. Elizabeth Oxley, servant to one Rind in Fetter-lane, having set her master's house on fire, was apprehended on suspicion, and confessed, that she had been hired to do it by one Stubbs a Papist, for a reward of 5l. Stubbs being taken into custody, acknowledged that he had persuaded her to it; and that he himself had been prevailed upon by one father Gifford his confessor, who had assured him, that by burning the houses of heretics he would do a great service to the church. He also owned that he had several conferences with Gifford and two Irishmen on the affair. The maid and Stubbs also agreed in declaring, that the Papists intended to rise in London, expecting to be powerfully supported by a French army. In consequence of this discovery, the Papists were banished from the city and ten miles round, and five Jesuits were hanged for the abovementioned plot.

The Papists thought to revenge themselves, by forging what was called the *meal-tub plot*, in which the

Presbyterians were supposed to hatch treacherous designs against the life of the king. Sir Edmondbury Godfrey also, who had been very active in his proceedings against the Papists, was murdered by some unknown persons; and this murder, together with their discovering the falsehood of the meal-tub plot, so exasperated the Londoners, that they resolved to show their detestation of Popery, by an extraordinary exhibition on the 17th of November, Queen Elizabeth's accession to the throne, on which day they had usually burnt the pope in effigy. The procession began with a person on horseback personating Sir Edmondbury Godfrey, attended by a bell-man proclaiming his execrable murder. He was followed by a person carrying a large silver cross, with priests in copes, Carmelites, and Gray-friars, followed by six Jesuits: then proceeded divers waiters, and after them some bishops with lawn-sleeves, and others with copes and mitres. Six cardinals preceded the pope, enthroned in a stately pageant, attended by divers boys with pots of incense, and the devil whispering in his ear. In this order they marched from Bishopsgate to Fleet-street; and there, amidst a great multitude of spectators, committed his holiness to the flames.

This procession gave great offence to the court, at which the duke of York, afterwards James II. had a great influence. The breach was farther widened by the choice of sheriffs for that year. The candidates set up by the court were rejected by a majority of almost two to one; but this did not deter their party from demanding a poll in their behalf, upon which a tumult ensued. This was represented by the Popish party in such colours to the king, that he issued out a commission that same evening for trying the rioters; which, however, was so far from intimidating the rest, that they grew more and more determined, not only to oppose the Popish party, but to exclude the duke of York from his succession to the crown.

In the mean time, the king prorogued the parliament, to prevent them from proceeding in their inquiry concerning the Popish plot, and the exclusion-bill. Upon this the lord-mayor, aldermen, and common-council, presented a petition to his majesty, in which they requested, that he would permit the parliament to sit in order to complete their salutary measures and councils. This petition was highly resented by the king; who, instead of granting it, dissolved the parliament, and could never afterwards be reconciled to the city. From this time it was determined to seize their charter; and fresh provocations having been given about the election of sheriffs, a *quo warranto* was at last produced by the attorney-general, in order to overthrow their charter, and thereby to deprive the citizens of the power to choose sheriffs, against the city. This information set forth, That "the mayor and commonalty and citizens of the city of London, by the space of a month then last past and more, used, and yet do claim to have and use, without any lawful warrant or regal grant, within the city of London aforesaid, and the liberties and privileges of the same city, the liberties and privileges following, viz. 1. To be of themselves a body corporate and politic, by the name of *mayor and commonalty and citizens of the city of London*. 2. To have *sheriffs civitatis et com. London. Et com. Middlesex*, and to name, make, and elect, and constitute

London.

25
Which gives occasion to a quarrel with the court.

24
A design to set it on fire again.

26
A Quo Warranto granted against the city.

London.

constitute them. 3. That the mayor and aldermen of the said city should be justices of the peace, and hold sessions of the peace. All which liberties, privileges, and franchises, the said mayor and commonalty, and citizens of London, upon the king did by the space aforesaid usurp, and yet do usurp."

Though nothing could be more unjust than this prosecution, the ministry were determined at all events to crush the Londoners; rightly judging, that it would be an easy matter to make all other corporations surrender their charters into the king's hands, and that they had no other body in the nation to fear. Accordingly they displaced such judges as would not approve of their proceedings; and, on the 12th of June 1683, Justice Jones pronounced the following sentence: "That a city might forfeit its charter; that the malversations of the common-council were acts of the whole city; and that the points set forth in the pleadings were just grounds for the forfeiting of a charter."

Notwithstanding this sentence, however, the attorney-general, contrary to the usual custom in such cases, was directed to move that the judgment might not be recorded; being afraid of the consequences. Yet it was judged that the king might seize the liberties of the city. A common-council was immediately summoned to deliberate on this exigency. The country party moved to have the judgment entered; but they were over-ruled by the court-party, who insisted upon an absolute submission to the king before judgment was entered; and though this was in effect a voluntary surrender of the city liberties, and depriving themselves of the means of getting the judgment reversed, the act of submission was carried by a great majority: and in a petition from the lord-mayor, aldermen, and common-council, they "acknowledged their own misgovernment, and his majesty's lenity; begged his pardon, and promised constant loyalty and obedience; and humbly begged his majesty's commands and directions." To this his majesty answered, that he would not reject their suit, if they would agree upon the following particulars. 1. That no lord-mayor, sheriff, recorder, common serjeant, town-clerk, or coroner, of the city of London, or steward of the borough of Southwark, shall be capable of, or admitted to, the exercise of their respective offices before his majesty shall have approved of them under his sign manual. 2. That if his majesty shall disapprove the choice of any person to be lord mayor, and signify the same under his sign manual to the lord mayor, or, in default of a lord mayor, to the recorder or senior alderman, the citizens shall, within one week, proceed to a new choice: and if his majesty shall in like manner disapprove the second choice, his majesty may, if he pleases, nominate a person to be lord mayor for the year ensuing. 3. If his majesty shall, in like manner, disapprove the persons chosen to be sheriffs, or either of them, his majesty may appoint sheriffs for the year ensuing. 4. That the lord mayor and court of aldermen may, with the leave of his majesty, displace any alderman, recorder, &c. 5. Upon the election of an alderman, if the court of aldermen shall judge and declare the person presented to be unfit, the ward shall choose again; and upon a disapproval of a second choice, the court may appoint another in

his room. 6. That the justices of the peace should be by the king's commission; and the settling of those matters to be left to his majesty's attorney-general, and counsel learned in the law."

To these the lord keeper added, in the king's name, "That these regulations being made, his majesty would not only pardon this prosecution, but would confirm their charter in such a manner as should be consistent with them;" concluding thus: "My lord mayor, the term draws towards an end, and Midsummer-day is at hand, when some of the officers used to be chosen; whereof his majesty will reserve the approbation. Therefore, it is his majesty's pleasure, that you return to the city, and consult the common-council, that he may speedily know your resolutions thereupon, and accordingly give his directions. That you may see the king is in earnest, and the matter is not capable of delay, I am commanded to let you know he hath given orders to his attorney-general to enter upon judgment on Saturday next; unless you prevent it by your compliance in all these particulars."

A common-council was summoned, when the friends of liberty treated those slavish conditions as they deserved; and even declared, that they were ready to sacrifice all that was near or dear to them, rather than submit to such arbitrary impositions: but when it was put to the vote, there appeared a majority of 18 for submission.

Thus the king got the government of the city into his own hands, though he and his brothers entirely lost the affections of the Londoners. But, not content with their submission, his majesty departed from his promise; commanded the judgment upon the *quo warranto* to be entered; and commissioned Sir William Pritchard, the lord mayor, to hold the same office during his majesty's pleasure. In the same manner he appointed or displaced the other magistrates as he thought proper; after which the ministry, having nothing to fear, proceeded in the most arbitrary manner.

In this subjection to the will of the court, the city of London continued till the Revolution: but, in 1689, the immediate restoration of the Londoners to their franchises was ordered; and in such a manner and form, as to put it out of the powers of an arbitrary ministry and a corrupt judge and jury to deprive them of their chartered liberties for the time to come. Accordingly a bill was brought into parliament, and passed, for reversing the judgment of the *quo warranto* against the city of London, and for restoring the same to its ancient rights and privileges. Since that time the city of London hath enjoyed tranquillity; its commerce hath been carried to the highest pitch; and for the politeness, riches, and number of its inhabitants, as well as its extent and the magnificence of its buildings, is inferior to no city in Europe, if not superior to every one.

That part of this immense capital which is distinguished by the name of *The City*, stands on the north shore of the river, from the Tower to the Temple, occupying only that space formerly encompassed by the wall, which in circumference measures but three miles and 165 feet. In this wall there were seven gates by land, viz. Ludgate, Aldgate, Cripplegate, Aldersgate, Moorgate, Bishopgate, which were all taken down in September 1762; and Newgate, the county gaol, which was also taken down in 1776, and a massive building,

27
Conditions
of reconciliation
between the
king and
city.

28

29
Privileges
of the city30
Description
of the city

London.

building erected a little south of it, which by the rioters in 1780 received damage to the amount of £.80,000. On the side of the water there were Dowgate and Billingsgate, long since demolished, as well as the postern-gate near the Tower. In the year 1670 there was a gate erected called Temple-Bar, which terminates the bounds of the city westward. The *hinteries*, or those parts of this great city which are subject to its jurisdiction and lie without the walls of London, are bounded on the east, in White-chapel, the Minories, and Bishopsgate, by bars, which were formerly posts and chains, that were frequently taken away by arbitrary power, when it was thought proper to seize the franchises of the city of London: on the north, they are bounded in the same manner in Pick-axe street, at the end of Fan-alley, and in St John's street: on the west, by bars in Holborn: at the east end of Middle Row, and at the west end of Fleet-street, by the gate called *Temple-Bar*, already mentioned: on the south, we may include the jurisdiction which the city holds on the river Thames, and over the borough of Southwark.

The city, including the borough, is at present divided into 26 wards.

31
Division in-
to wards.

1. *Aldersgate ward* takes its name from a city-gate which lately stood in the neighbourhood. It is bounded on the east by Cripplegate ward; on the west, by Farringdon ward within and without; and on the south, by Farringdon ward within. It is very large, and is divided into Aldersgate-within and Aldersgate-without. Each of these divisions consists of four precincts, under one alderman, eight common-council men, of whom two are the alderman's deputies, eight constables, fourteen inquest-men, eight scavengers, and a beadle; exclusive of the officers belonging to the liberty of St Martin's le Grand, which contains 168 houses.

2. *Aldgate* takes its name also from a gate, which was of great antiquity, being mentioned in king Edgar's charter to the knights of the Knighton Guild about the year 967; and was probably of a much more ancient foundation, for it was the gate through which the Roman Vicinal way lay to the ferry at Oldford. In the time of the wars betwixt king John and his barons, the latter entered the city through this gate, and committed great devastations among the houses of the religious. Aldgate was rebuilt by the leaders of the party after the Roman manner. They made use of stone which they brought from Caen, and a small brick called the *Flanders tile*, which Mr Pennant thinks has been often mistaken for Roman. The new gate was very strong, and had a deep well within it. In 1471 this gate was assaulted by the Bastard of Falconbridge, who got possession of it for a few hours; but the portcullis being drawn up, the troops which had entered were all cut off, and the citizens, headed by the alderman of the ward and recorder, having made a rally, defeated the remainder with great slaughter. In 1606 Aldgate was taken down and rebuilt; and many Roman coins were found in digging the foundations.—The ward of Aldgate is bounded on the east by the city-wall, which divides it from Port-foken-ward; on the north, by Bishopsgate ward; on the west, by Lime-street and Langbourn wards; and on the south, by Tower-street ward. It is governed by an alderman, six common-council men, six constables, N° 186.

twenty inquest-men, seven scavengers, and a beadle; London. besides the officers belonging to St James's, Duke's Place.—It is divided into seven precincts.

3. *Bassishaw* or *Basinghall ward*, is bounded on the east and south by Coleman-street ward, on the north by part of Cripplegate, and on the west by part of the wards of Cheap and Cripplegate. On the south, it begins at Blackwell-hall; and runs northward to London-wall, pulled down some time ago to make way for new buildings in *Foresstreet*, and spreads 88 feet east, and 54 feet west against the place where that wall stood. This is a very small ward, and consists only of two precincts: the upper precinct contains no more than 66, and the lower only 76 houses. It is governed by an alderman, four common-council men, of whom one is the alderman's deputy, three constables, seventeen inquest-men, three scavengers, and a beadle. It has its name from Basinghall, the mansion-house of the family of *Bafin*, which was the principal house in it, and stood in the place of Blackwell-hall.

4. *Billingsgate ward* is bounded on the east by Tower-street ward; on the north, by Langbourn ward; on the west, by the ward of Bridge-within; and on the south, by the river Thames. There have been many conjectures concerning the origin of the name of *Billingsgate*, none of which seems to be very well authenticated. It is, for instance, supposed to have derived its name from a British king named *Belinus*, said to have been an assistant of Brennus king of the Gauls at the taking of Rome, and is the same with the *Bel-Maur* mentioned in the Welsh genealogies. The name of *Ludgate* is said to be derived from his son *Lud*.—It is divided into 12 precincts; and is governed by an alderman, 10 common-council men, one of whom is the alderman's deputy, 11 constables, 14 inquest-men, six scavengers, and a beadle. The situation of Billingsgate, on the river, gives it great advantages with respect to trade and merchandise; so that it is well inhabited, and is in a continual hurry of business at the several wharfs or quays.

5. *Bishopsgate ward* is bounded on the east by Aldgate ward, Portfoken ward, and part of the Tower-liberty, or Norton-falgate; on the west, by Broad-street ward and Moorfields; and on the south, by Langbourn ward. It is very large, and divided into Bishopsgate-within and Bishopsgate-without. The first contains all that part of the ward within the city-wall and gate, and is divided into five precincts; the second lies without the wall, and is divided into four precincts. Bishopsgate-without extends to Shoreditch, taking its name from one Sir John de Sordich, an eminent lawyer much in favour with king Edward III. both on account of his knowledge in the law, and of his personal valour. In the time of Henry VIII. one Barlo, a citizen and inhabitant of this place, was named *duke of Shoreditch*, on account of his skill in archery; and, for a number of years after, the title belonged to the captain of the London archers. This ward is governed by an alderman, two deputies, one within and the other without, 12 common-council men, seven constables, 13 inquest-men, nine scavengers, and two beadles. It took its name from the gate, which has been pulled down to make that part of the city more airy and commodious. This gate was built by

Erkenwald

London. Erkenwald bishop of London in 675; and it is said to have been repaired by William the Conqueror soon after the Norman conquest. In the time of Henry III. the Hanse merchants had certain privileges confirmed to them, in return for which they were to support this gate; and in consequence of this they rebuilt it elegantly in 1479. There were two statues of bishops, in memory of the founder and first repairer; other two were also put up, which are supposed to have been designed for Alfred and Ældred earl of Mercia, to whose care the gate had been committed.

6. *Bread-street ward* is encompassed, on the north and north-west, by the ward of Faringdon-within; on the east, by Cordwainer's ward; on the south by Queen-hite-ward; and on the west, by Castle-Baynard ward. It is divided into 13 precincts; and is governed by an alderman; 12 common-council-men, of whom one is the alderman's deputy, 13 constables, 13 inquest-men, 13 scavengers, and a beadle; and yet contains no more than 331 houses. It takes its name from the ancient bread-market, which was kept in the place now called *Bread-street*; the bakers being obliged to sell their bread only in the open market and not in shops.

7. *Bridge-ward within* is bounded on the south by the river Thames and Southwark; on the north, by Langbourn and Bishopsgate ward; on the east, by Billingsgate; and on the west, by Candlewick and Dowgate wards. It is divided into 14 precincts, three of which were on London-bridge; and is governed by an alderman, 15 common-council men, one of whom is the alderman's deputy, 14 constables, 15 inquest-men, 14 scavengers, and a beadle. It takes its name from its connection with London-bridge.

8. *Broad-street ward* is bounded, on the north and east, by Bishopgate ward; on the south, by Cornhill and Wallbrook ward; and on the west by Coleman-street ward. It is divided into 10 precincts; and governed by an alderman, 10 common-council men, one of whom is the alderman's deputy, 10 constables, 13 inquest-men, eight scavengers, and a beadle. It has its name from that part of it now distinguished by the name of *Old Broad-street*; and which, before the fire of 1666, was accounted one of the broadest streets in London.

9. *Candlewick ward, Candlewick-street, or Candlewright street ward* as it is called in some ancient records, is bounded on the east by Bridge ward; on the south, by Dowgate and part of Bridge ward; on the west, by Dowgate and Wallbrook; and on the north, by Langbourn ward. It is but a small ward, consisting of about 286 houses; yet is divided into seven precincts. It is governed by an alderman, eight common-council men, of whom one is the alderman's deputy, seven constables, 13 inquest-men, seven scavengers, and a beadle. It has its name from a street, formerly inhabited chiefly by candlewrights or candle-makers, both in tallow and wax: a very profitable business in the times of Popery, when incredible quantities of wax-candles were consumed in the churches. That street, however, or at least its name, *Candlewick*, is lost since the great conflagration, for which the name *Canon-street* is substituted, the candlewrights being at that time burnt out and dispersed through the city.

10. *Castle-Baynard ward* is bounded by Queen-

hithe and Bread-street wards on the east; on the south, by the Thames; and on the west and north, by the ward of Faringdon-within. It is divided into 10 precincts, under the government of an alderman, 10 common-council-men, one of whom is the alderman's deputy, nine constables, 14 inquest-men, seven scavengers, and a beadle. It takes its name from a castle built on the bank of a river by one Baynard, a soldier of fortune, who came in with William the Conqueror, and was by that monarch raised to great honours and authority.

11. *Cheap ward* is bounded on the east by Broad-street and Broadbrook wards; on the north, by Coleman-street, Bassishaw, and Cripple-gate; and on the south, by Cordwainer's ward. It is divided into nine precincts; and is governed by an alderman, 12 common-council men, of whom one is the alderman's deputy, 11 constables, 13 inquest-men, nine scavengers, and a beadle. It has its name from the Saxon word *chepe*, which signifies a market, kept in this division of the city, now called *Cheapside*; but then known by the name of *Westeheap*, to distinguish it from the market then also kept in Eastcheap, between Canon or Candlewick street and Tower-street.

12. *Coleman-street ward* is bounded on the east by Bishopgate, Broadstreet, and Cheap wards; on the north, by Cripple-gate ward, Middle Moorfields, and Bishopgate; on the south, by Cheap ward; and on the west, by Bassishaw ward. It is divided into six precincts; and is governed by an alderman, six common-council men, one of whom is the alderman's deputy, six constables, 13 inquest-men, six scavengers, and a beadle. The origin of the name is not certainly known.

13. *Cordwainers ward* is bounded on the east by Wallbrook, on the south by Vintry ward, on the west by Bread-street, and on the north by Cheap-ward. It is divided into eight precincts; and is governed by an alderman, eight common-council men, one of whom is the alderman's deputy, eight constables, 14 inquest men, eight scavengers, and a beadle. Its proper name is *Cordwainers-street ward*; which it has from Cordwainers street, now Bow-lane, formerly occupied chiefly by shoemakers and others that dealt or worked in leather.

14. *Cornhill ward* is but of small extent. It is bounded on the east by Bishopgate, on the north by Broad street, on the west by Cheap ward, and on the south by Langbourn ward. It is divided into four precincts, which are governed by one alderman, six common-council men, of whom one is the alderman's deputy, four constables, 16 inquest-men, four scavengers, and a beadle. It takes its name from the principal street in it, known from the earliest ages by the name of *Cornhill*, because the corn-market was kept there.

15. *Cripple-gate ward* is bounded on the east by Moorfields, Coleman-street ward, Bassishaw ward, and Cheap ward; on the north by the parish of St Luke's, Old-street; on the west, by Alder-gate ward; and on the south, by Cheap-ward. It is divided into 13 precincts, nine within and four without the wall; and is governed by an alderman, 12 common council men, of whom two are the alderman's deputies, 13 constables, 34 inquest-men, 16 scavengers, and three beades. It

London. takes its name from Cripplegate, which stood on the north-west part of the city-wall. It was an old plain structure, void of all ornament, with one postern; but had more the appearance of a fortification than any of the other gates. It was removed in order to widen the entrance into Wood-street, which, by the narrowness of the gateway, was too much contracted and rendered dangerous for passengers and great waggon.

16. *Dowgate ward* is bounded on the east by Candlewick and Bridge wards, on the north by Wallbrook ward, on the west by Vintry ward, and on the south by the Thames. It is divided into eight precincts, under the government of an alderman, eight common-council men, of whom one is the alderman's deputy, eight constables, 15 inquest-men, five scavengers, and a beadle. It has its name from the ancient water-gate, called *Dowgate*, which was made in the original wall that ran along the north side of the Thames, for the security of the city against all attempts to invade it by water.

17. *Farringdon ward within* is bounded on the east by Cheap ward and Baynard-cattleward; on the north, by Aldersgate and Cripplegate wards, and the liberty of St Martin's le Grand; on the west, by Farringdon-without; and on the south, by Baynard-cattle ward, and the river Thames. It is divided into 18 precincts; and governed by one alderman, 17 common-council men, of whom one is the alderman's deputy, 19 constables, 17 inquest-men, 19 scavengers, and two beades. It takes its name from William Farringdon citizen and goldsmith of London, who, in 1279, purchased all the aldermanry with the appurtenances, within the city of London and suburbs of the same, between Ludgate and Newgate, and also *without* these gates.

18. *Farringdon-ward without* is bounded on the east by *Farringdon within*, the precinct of the late priory of St Bartholomew near Smithfield, and the ward of Aldersgate; on the north, by the charter-house, the parish of St John's Clerkenwell, and part of St Andrew's parish without the freedom; on the west, by High Holborn and St Clement's parish in the Strand; and on the South by the river Thames. It is governed by one alderman, 16 common-council men, of whom two are the alderman's deputies, 23 constables, 48 inquest-men; 24 scavengers; and four beades. It takes its name from the same goldsmith who gave name to Farringdon-within.

19. *Langborn ward* is bounded on the east by Aldgate ward; on the north, by part of the same, and Limestreet ward; on the south, by Tower-street, Billingsgate, Bridge, and Candlewick wards; and on the west by Wallbrook. It is divided into 12 precincts. It had its name from a rivulet or long bourn of fresh-water, which anciently flowed from a spring near Magpye alley adjoining to St Catherine Coleman's church.

20. *Limestreet ward* is bounded on the east and north by *Aldgate ward*, on the west by Bishopsgate; and on the south by Langbourn ward. It is divided into four precincts; and governed by an alderman, four common-council men, one of whom is the alderman's deputy, four constables, 13 inquest-men, four scavengers, and a beadle. It is very small; and has its name

from some lime-kilns that were formerly built in or near Lime-street.

21. *Portoken ward* is bounded on the east by the parishes of Spitalfields, Stepney, and St George's in the east; on the south, by Tower-hill; on the north, by Bishopsgate ward, and on the west by Aldgate ward. It is divided into five precincts; and is governed by an alderman, five common-council men, one of whom is the alderman's deputy, five constables, 19 inquest-men, five scavengers, and a beadle. Its name signifies the *franchise of the liberty gate*. This Portoken was for some time a guild; and had its beginning in king Edgar, when 13 knights, "well-beloved of the king and realm, for services by them done," requested to have a certain portion of land on the east part of the city left desolate and forsaken of the inhabitants by reason of too much servitude. They besought the king to have this land, with the liberty of a guild for ever. The king granted their request on the following conditions, *viz.* that each of them should victoriously accomplish three combats, one above the ground, one under ground, and the third in the water: and after this, at a certain day, in East Smithfield, they should run with spears against all comers. All this was gloriously performed; upon which the king named it *Knighten Guild*, and extended it from Aldgate to the places where the bars now are on the east, and to the Thames on the south, and as far into the water as an horseman could ride at low water and throw his spear.

22. *Queen-hithe ward* is bounded on the east by Dowgate, on the north by Bread-street and Cordwainers wards, on the south by the Thames, and on the west by Castle-Baynard ward. It is divided into nine precincts; and is governed by one alderman, six common-council men, one of whom is the alderman's deputy, and nine constables. It has its name from the *hithes*, or harbour for large boats, barges, and lighters; for which, and even for ships, it was the anchoring place, and the key for lading and unloading vessels almost of any burden used in ancient times. It has the name of *queen*, because the queens of England usually possessed the tolls and customs of vessels that unloaded goods at this hithe, which were very considerable.

23. *Tower ward*, or *Tower-street ward*, is bounded on the south by the river Thames, on the east by Tower-hill and Aldgate ward, on the north by Langbourn ward, and on the west by Billingsgate ward. It is governed by one alderman, 12 common-council men, of whom one is the alderman's deputy, 12 constables, 13 inquest men, 12 scavengers, and one beadle. It takes its name from *Tower-street*, so called because it leads out of the city in a direct line to the principal entrance of the Tower of London.

24. *Vintry ward* is bounded on the east by Dowgate, on the south by the Thames, on the west by Queen-hithe ward, and on the north by Cordwainers ward. It is a small ward, containing only 418 houses; but is divided into nine precincts, and governed by an alderman, nine common-council men, one of whom is the alderman's deputy, nine constables, 13 inquest-men, three scavengers, and a beadle. It takes its name from the vintners or wine-merchants of Bourdeaux, who formerly dwelt in this part of the city, were obliged to land their wines on this spot, and to sell them in 40 days, till the 28th of Edward I.

London.

25. *Wallbrook ward* is bounded on the east by Lambourn, on the south by Dowgate ward, on the west by Cordwainers ward, and on the north by Cheap ward. It is small, containing only 306 houses; but is divided into seven precincts, and governed by an alderman, eight common-council men, of whom one is the alderman's deputy, seven constables, 13 inquest-men, six scavengers, and a beadle. It has its name from the rivulet *Wallbrook*, that ran down the street of this name into the river Thames near Dowgate; but in process of time it was so lost by covering it with bridges and buildings upon those bridges, that its channel became a common sewer.

26. The ward of *Bridge-without* includes the borough of Southwark, and the parishes of Rotherhithe, Newington, and Lambeth. It has its name from London-bridge, with the addition of the word *without*, because the bridge must be passed in order to come at it. *Westminster* is generally reckoned a part of London, tho' under a distinct government; and has long been famous for the palaces of our kings, the seat of our law tribunals, and of the high court of parliament; all which shall be described in their order.

The city and liberties of London are under an ecclesiastical, a civil, and a military government.

As to its *ecclesiastical* government, London is a bishop's see, the diocese of which comprehends not only Middlesex, Essex, and part of Hertfordshire, but the British plantations in America. The bishop of London takes precedence next to the archbishops of Canterbury and York; but the following parishes of this city are exempt from his jurisdiction, being peculiars under the immediate government of the archbishop of Canterbury; *viz.* All-hallows in Bread-street, All-hallows Lombard-street; St Dionys Back-church, St Dunstan in the East, St John Baptist, St Leonard Eastcheap, St Mary Aldermay, St Mary Bothaw, St Mary le Bow, St Michael Crooked-lane, St Michael Royal, St Pancras Soper-lane, and St Vedast Foster-lane.

The *civil* government of London divides it into wards and precincts, under a lord-mayor, aldermen, and common-council.

The mayor, or lord-mayor, is the supreme magistrate, chosen annually by the citizens, pursuant to a charter of King John. The present manner of electing a lord-mayor is by the liverymen of the several companies, assembled in Guildhall annually on Michaelmas-day, according to an act of common council in A. D. 1476, where, and when, the liverymen choose, or rather nominate, two aldermen below the chair, who have served the office of sheriff, to be returned to the court of aldermen, who may choose either of the two; but generally declare the senior of the two, to be returned, to be lord-mayor elect. The election being over, the lord-mayor elect, accompanied by the recorder and divers aldermen, is soon after presented to the lord-chancellor (as his majesty's representative in the city of London) for his approbation; and on the 9th of November following is sworn into the office of mayor at Guildhall; and on the day after, before the barons of the exchequer at Westminster; the procession on which occasion is exceedingly grand and magnificent.

The lord-mayor sits every morning at the mansion-house, or place where he keeps his mayoralty, to de-

termine any difference that may happen among the citizens, and to do other business incident to the office of a chief magistrate. Once in six weeks, or eight times in the year, he sits as chief judge of Oyer and Terminer, or gaol-delivery of Newgate for London and the county of Middlesex. His jurisdiction extends all over the city and suburbs, except some places that are exempt. It extends also from Colneyditch, above Staines-bridge in the west, to Yeudale, or Yensflete, and the mouth of the river Medway, and up that river to Upnor-castle, in the east; by which he exercises the power of punishing or correcting all persons that shall annoy the streams, banks, or fish. For which purpose his lordship holds several courts of conservancy in the counties adjacent to the said river, for its conservation, and for the punishment of offenders. See the article *MAYOR'S-COURT*.

The title of dignity, *alderman*, is of Saxon original, and of the greatest honour, answering to that of earl; though now it is nowhere to be found but in chartered societies. And from hence we may account for the reason why the aldermen and commonalty of London were called *barons* after the conquest. These magistrates are properly the subordinate governors of their respective wards under the lord-mayor's jurisdiction; and they originally held their aldermanries either by inheritance or purchase; at which time the aldermanries or wards changed their names as often as their governors or aldermen. The oppressions, to which the citizens were subject from such a government, put them upon means to abolish the perpetuity of that office; and they brought it to an annual election. But that manner of election being attended with many inconveniences, and becoming a continual bone of contention amongst the citizens, the parliament, 17 Richard II. A. D. 1394, enacted, That the aldermen of London should continue in their several offices during life or good behaviour. And so it still continues: though the manner of electing has several times varied. At present it is regulated by an act of parliament, passed in the year 1724-5: and the person so elected is to be returned by the lord-mayor (or other returning officer in his stead, duly qualified to hold a court of wardmote) to the court of lord-mayor and aldermen, by whom the person so returned must be admitted and sworn into the office of alderman before he can act. If the person chosen refuse to serve the office of alderman, he is finable 500 l.

These high officers constitute a second part of the city legislature when assembled in a corporate capacity, and exercise an executive power in their respective wards. The aldermen who have passed the chair, or served the high office of lord-mayor, are justices of the quorum; and all the other aldermen are not only justices of the peace, but by the statute of 43 Eliz. intitled, *An act for the relief of the poor*, "every alderman of the city of London, within his ward, shall and may do and execute, in every respect, so much as is appointed and allowed by the said act to be done or executed by one or two justices of peace of any county within this realm." They every one keep their *wardmote*, or court, for choosing ward-officers and settling the affairs of the ward, to redress grievances, and to prevent all defaults found within their respective wards.

The next branch of the legislative power in this city

London.

Aldermen.

32
Government
of London.33
Ecclesiastical.34
Civil.35
Lord-mayor.

London.

36
Common-council.

city is the *common-council*. The many inconveniences that attended popular assemblies, which were called *folk-motes*, determined the commonality of London to choose representatives to act in their name and for their interest, with the lord-mayor and aldermen, in all affairs relating to the city. At first these representatives were chosen out of the several companies: but that not being found satisfactory, nor properly the representatives of the whole body of the inhabitants, it was agreed to choose a certain number of discreet men out of each ward: which number has from time to time increased according to the dimensions of each ward: and at present the 25 wards, into which London is divided, being subdivided into 236 precincts, each precinct sends a representative to the common-council, who are elected after the same manner as an alderman, only with this difference, that as the lord-mayor presides in the wardmote, and is judge of the poll at the election of an alderman, so the alderman of each ward is judge of the poll at the election of a common-council man.

Thus the lord-mayor, aldermen, and common-council, when assembled, may be deemed the city parliament, resembling the great council of the nation. For it consists of two houses; one for the lord-mayor and aldermen, or the upper-house; another for the commoners or representatives of the people, commonly called the *common-council men*. And they have power in their incorporate capacity to make and repeal by-laws; and the citizens are bound to obey or submit to those laws. When they meet in their incorporate capacity, they wear deep-blue silk gowns: and their assemblies are called the *court of common-council*, and their ordinances *acts of common-council*. No act can be performed in the name of the city of London without their concurrence. But they cannot assemble without a summons from the lord-mayor; who, nevertheless, is obliged to call a common-council, whenever it shall be demanded, upon extraordinary occasions, by six reputable citizens and members of that court.

37
Sheriffs.

This corporation is assisted by two sheriffs and a recorder. The sheriffs are chartered officers, to perform certain suits and services, in the king's name, within the city of London and county of Middlesex, chosen by the liverymen of the several companies on Midsummer day. Their office, according to Camden, in general, is to collect the public revenues within their several jurisdictions; to gather into the exchequer all fines belonging to the crown; to serve the king's writs of process; to attend the judges, and execute their orders; to impanel juries; to compel headstrong and obstinate men by the *posse comitatus* to submit to the decisions of the law; and to take care that all condemned criminals be duly punished and executed. In particular, in London, they are to execute the orders of the common-council, when they have resolved to address his majesty, or to petition parliament.

The sheriffs, by virtue of their office, hold a court at Guildhall every Wednesday and Friday, for actions entered at Wood-fleet Compter; and on Thursdays, and Saturdays for those entered at the Poultry Compter: of which the sheriffs being judges, each has his assistant, or deputy, who are called the judges of those courts; before whom are tried actions of debt, trespass, covenant, &c. and where the testimony of any

able witness in writing is allowed to be good evidence. To each of these courts belong four attorneys, who, upon their being admitted by the court of auditors, have an oath administered to them.

To each of these courts likewise belong a secondary, a clerk of the papers, a prothonotary, and four clerks-fitters. The secondary's office is to allow and return all writs brought to remove clerks out of the said courts; the clerk of the papers files and copies all declarations upon actions; the prothonotary draws and ingrosses all declarations; the clerk-fitters enter actions and attachments, and take bail and verdicts. To each of the compters, or prisons belonging to these courts, appertain 16 sergeants at mace, with a yeoman to each, besides inferior officers, and the prison-keeper.

In the sheriffs court may be tried actions of debt, case, trespass, account, covenant, and all personal actions, attachments, and sequestrations. When an erroneous judgment is given in either of the sheriffs courts of the city, the writ of error to reverse this judgment must be brought in the court of hustings before the lord mayor; for that is the superior court. The sheriffs of London may make arrests and serve executions on the river Thames.

38
Recorder.

We do not read of a recorder till the 1304, who, by the nature of his office, seems to have been intended as an assistant to, or assessor with, the lord-mayor, in the execution of his high office, in matters of justice and law. He is chosen by the lord-mayor and aldermen only; and takes place in all courts, and in the common-council, before any one that hath not been mayor. Of whom we have the following description in one of the books of the chamber. "He shall be, and is wont to be, one of the most skilful and virtuous apprentices of the law of the whole kingdom; whose office is always to sit on the right hand of the mayor, in recording pleas, and passing judgments; and by whom records and processess, had before the lord-mayor and aldermen at Great St Martin's, ought to be recorded by word of mouth before the judges assigned there to correct errors. The mayor and aldermen have therefore used commonly to set forth all other business, touching the city, before the king and his council, as also in certain of the king's courts, by Mr Recorder, as a chief man, endowed with wisdom, and eminent for eloquence."—Mr Recorder is looked upon to be the mouth of the city, to deliver all addresses to the king, &c. from the corporation; and he is the first officer in order of precedence that is paid a salary, which originally was no more than 10*l*. Sterling *per annum*, with some few perquisites; but it has from time to time been augmented to 1000*l*. *per annum*, and become the road to preferment in the law. This office has sometimes been executed by a deputy.

The next chartered officer of this corporation is the chamberlain; an office of great repute and trust, and is in the choice of the livery annually. This officer, though chosen annually on Midsummer-day, is never displaced during his life, except some very great crime can be made out against him. He has the keeping of the moneys, lands, and goods, of the city-orphans, or takes good security for the payment thereof when the parties come to age. And to that end he is deemed in the law a sole corporation, to him and his successors.

39
Chamberlain.

London. fors, for orphans; and therefore a bond or a recognition made to him and his successors, is recoverable by his successors. This officer hath a court peculiarly belonging to him. His office may be termed a public treasury, collecting the customs, moneys, and yearly revenues, and all other payments belonging to the corporation of the city. It was customary for government to appoint the chamberlain receiver of the land tax; but this has been discontinued for several years past.

40
Other of-
ficers.

The other officers under the lord-mayor are, 1. The common serjeant. He is to attend the lord-mayor and court of aldermen on court-days, and to be in council with them on all occasions, within or without the precincts or liberties of the city. He is to take care of orphans estates, either by taking account of them, or to sign their indentures, before their passing the lord-mayor and court of aldermen. And likewise he is to let, set, and manage the orphans estates, according to his judgment, to the best advantage. 2. The town-clerk; who keeps the original charter of the city, the books, rolls, and other records, wherein are registered the acts and proceedings of the city; so that he may not be improperly termed the city-register: he is to attend the lord-mayor and aldermen at their courts, and signs all public instruments. 3. The city-remembrancer; who is to attend the lord-mayor on certain days, his business being to put his lordship in mind of the feoff days he is to go abroad with the aldermen, &c. He is to attend daily at the parliament-house, during the sessions, and to report to the lord-mayor their transactions. 4. The sword-bearer; who is to attend the lord-mayor at his going abroad, and to carry the sword before him, being the emblem of justice. This is an ancient and honourable office, representing the state and princely office of the king's most excellent majesty, in his representative the lord-mayor; and, according to the rule of armory, "He must carry the sword upright, the hilts being holden under his bulk, and the blade directly up the middle of his breast, and so forth between the sword-bearer's brows." 5. The common-hunt; whose business it is to take care of the pack of hounds belonging to the lord-mayor and citizens, and to attend them in hunting in those grounds to which they are authorized by charter. 6. The common-crier. It belongs to him and the serjeant at arms, to summon all executors and administrators of freemen to appear, and to bring in inventories of the personal estates of freemen, within two months after their decease: and he is to have notice of the appraisements. He is also to attend the lord-mayor on set days, and at the courts held weekly by the mayor and aldermen. 7. The water-bailiff; whose office is to look after the preservation of the river Thames against all encroachments; and to look after the fishermen for the preservation of the young fry, to prevent the destroying them by unlawful nets. For that end, there are juries for each county, that hath any part of it lying on the sides or shores of the said river; which juries, summoned by the water-bailiff at certain times, do make inquiry of all offences relating to the river and the fish, and make their presentments accordingly. He is also bound to attend the lord-mayor on set days in the week.—These seven purchase their places; except the town-clerk, who is chosen by the livery.

There are also three serjeant-carvers; three serjeants

of the chamber; a serjeant of the channel: four yeomen of the water-side; an under water-bailiff; two yeomen of the chamber; two meal-weighters; two yeomen of the wood wharfs; a foreign taker; city-marshals. There are besides these, seven gentlemen men; as, the sword-bearer's man, the common-hunt's two men, the common crier's man, and the carver's three men.

Nine of the foregoing officers have liveries of the lord-mayor, viz. the sword-bearer and his man, the three carvers, and the four yeomen of the water-side. All the rest have liveries from the chamber of London.

The following officers are likewise belonging to the city; farmer of the markets, auditor, clerk of the chamber, clerk to the commissioners of the sewers, clerk of the court of conscience, beadle of the same court, clerk of the city-works, printer to the city, justice of the Bridge-yard, clerk-comptroller of the Bridge-house, steward of the Borough, bailiff of the Borough.

There is also a coroner, called so from *corona*, i. e. a crown, because he deals principally with the crown, or in matters appertaining to the imperial crown of England. See the article CORONER.

Besides these officers, there are several courts in this city for the executing of justice, viz. the court of hustings, lord-mayor's court, &c. In the city there are also two subordinate kinds of government. One executed by the alderman, deputy, and common-council men, and their inferior officers, in each ward; under which form are comprehended all the inhabitants, free or not free of the city. Every ward is therefore like a little free state, and at the same time subject to the lord-mayor as chief magistrate of the city. The housekeepers of each ward elect their representatives, the common-council, who join in making bye-laws for the government of the city. The officers and servants of each ward manage the affairs belonging to it, without the assistance of the rest; and each has a court called the *wardmote*, as has been already described, for the management of its own affairs. The other, by the master, wardens, and court of assistants, of the incorporate companies; whose power reaches no further than over the members of their respective guilds or fraternities; except that in them is invested the power to choose representatives in parliament for the city; and all those magistrates and officers elected by a common-hall; which companies are invested with distinct powers, according to the tenor of their respective charters.

The military government of the city is lodged in a Military lieutenantancy, consisting of the lord-mayor, aldermen, and other principal citizens, who receive their authority by a commission from the king. Those have under their command the city trained bands, consisting of six regiments of foot, distinguished by the names of the *white, orange, yellow, blue, green, and red*, each containing eight companies of 150 men, amounting in all to 7200. Besides these six regiments, there is a corps called the *artillery company*, from its being taught the military exercise in the artillery-ground. This company is independent of the rest, and consists of 700 or 800 volunteers. All these, with two regiments of foot of 800 men each commanded by the lieutenant of the Tower of London, make the whole militia of this city; which,

London.

41
Military
gov-
ern-
ment.

London

which, exclusive of Westminster and the borough of Southwark, amounts to about 10,000 men.

43
Trading
companies.

The trading part of the city of London is divided into 89 companies; though some of them can hardly be called so, because they have neither charters, halls, nor livery. Of these 89 companies 55 have each a hall for transacting the business of the corporation; and this consists of a master or prime warden, a court of assistants, and livery.—Twelve of these companies are superior to the rest both in antiquity and wealth; and of one of those 12 the lord mayors have generally made themselves free at their election. These companies are the mercers, grocers, drapers, fish-mongers, goldsmiths, skinner, merchant-tailors, haberdashers, salters, iron-mongers, vintners, and clothworkers.—The principal incorporated societies of the merchants of this city are, the *Hamburgh Company*, the *Hudson's Bay Company*, the *Russia Company*, the *Turkey Company*, the *East India Company*, the *Royal African Company*, the *South Sea Company*, and some *Insurance Companies*. The most of these companies have stately houses for transacting their business, particularly the *East India* and *South Sea companies*. See *COMPANY*.

The streets and public buildings in London and its liberties being far too numerous for a particular description in this work, we shall only select the most remarkable, beginning with *London-Bridge* as the most ancient, and proceeding in our survey through the wards into which the city is divided.

43
Remarkable streets
and buildings
within
the
City.

1. *Remarkable buildings, &c. in the City*.—The original bridge, which stands in Bridge-ward, was of wood, and appears to have been first built between the years 993 and 1016; but being burnt down about the year 1130, it was rebuilt of wood in 1163. The expenses, however, of maintaining and repairing it became so burdensome to the inhabitants of the city, that they resolved to build a stone-bridge a little westward of the wooden one. This building was begun in 1176, and finished in 1209; and was 915 feet long, 44 feet high, and 73 feet wide; but houses being built on each side, the space between was only 23 feet.

44
London
bridge.

This great work was founded on enormous piles driven as closely as possible together: on their tops were laid long planks 10 inches thick, strongly bolted; and on them were placed the base of the pier, the lowermost stones of which were bedded in pitch, to prevent the water from damaging the work: round all were the piles which were called the *sterlings*, designed for the preservation of the foundation piles. These contracted the space between the piers so greatly, as to occasion at the retreat of every tide a fall of five feet, or a number of temporary cataracts, which

since the foundation of the bridge have occasioned the loss of many thousand lives. The number of arches was 19, of unequal dimensions, and greatly deformed by the *sterlings* and the houses on each side, which overhung and leaned in a most terrific manner. In most places they hid the arches, and nothing appeared but the rude piers. Within recollection, frequent arches of strong timber crossed the street from the tops of the houses to keep them together, and from falling into the river (A). Nothing but use could preserve the quiet of the inmates, who soon grew deaf to the noise of the falling waters, the clamours of watermen, or the frequent shrieks of drowning wretches. In one part had been a drawbridge, useful either by way of defence or for the admission of ships into the upper part of the river. This was protected by a strong tower. It served to repulse *Fauconbridge* the *Barbador* in his general assault on the city in 1471, with a set of banditti, under pretence of rescuing the unfortunate *Henry*, then confined in the Tower. Sixty houses were burnt on the bridge on the occasion. It also served to check, and in the end annihilate, the ill-conducted insurrection of *Sir Thomas Wyatt*, in the reign of *Queen Mary*. The top of this tower, in the sad and turbulent days of this kingdom, used to be the shambles of human flesh, and covered with heads or quarters of unfortunate partizans. Even so late as the year 1598, *Hentzner*, the German traveller, with German accuracy, counted on it above 30 heads. The old map of the city in 1597 represents them in a most horrible cluster.—An unparalleled calamity happened on this bridge within four years after it was finished. A fire began on it at the Southward end; multitudes of people rushed out of London to extinguish it, while they were engaged in this charitable design, the fire seized on the opposite end, and hemmed in the crowd. Above 3000 persons perished in the flames, or were drowned by overloading the vessels which were hardly enough to attempt their relief.

The narrowness of the passage on this bridge having occasioned the loss of many lives from the number of carriages continually passing; and the straitness of the arches, with the enormous size of the *sterlings*, which occupied one-fourth part of the water-way, having also occasioned frequent and fatal accidents, as already mentioned; the magistrates of London in 1756 obtained an act of parliament for improving and widening the passage over and through the bridge, which granted them a toll for every carriage and horse passing over it, and for every vessel with goods passing through it: but these tolls proving insufficient, were abolished by an act made in 1758 for explaining, amending, and rendering the former act more effectual; and for granting the city of London money towards carrying on that

London.

(A) The gallant action of *Edmund Osborne*, ancestor to the duke of Leeds, when he was apprentice to *Sir William Hewet* cloth-worker, may not improperly be mentioned in this place. About the year 1536, when his master lived in one of those tremendous houses, a servant-maid was playing with his only daughter in her arms in a window over the water, and accidentally dropt the child. Young *Osborne*, who was witness to the misfortune, instantly sprang into the river, and, beyond all expectation, brought her safe to the terrified family! Several persons of rank paid their addresses to her when she was marriageable, among others the earl of *Shrewsbury*; but *Sir William* gratefully decided in favour of *Osborne*: *Osborne*, says he, saved her, and *Osborne* shall enjoy her. In her right he possessed a great fortune. He became sheriff of London in 1575, and lord-mayor in 1582.

London. that work. In consequence of these acts of parliament, a temporary wooden bridge was built, and the houses on the old bridge were taken down. Instead of a narrow street 23 feet wide, there is now a passage of 31 feet for carriages, with a raised pavement of stone on each side 7 feet broad for the use of foot passengers. The fides are secured by stone balustrades, enlightened in the night with lamps. "The passage thro' the bridge is enlarged by throwing the two middle arches into one, and by other alterations and improvements; notwithstanding which, however, it is still greatly subject to its former inconveniences.—Under the first, second, and fourth arches, from the north side of the bridge, and now likewise towards the southern extremity, there are engines worked by the flux and reflux of the river, the water of which they raise to such a height as to supply many parts of the city. Those engines were contrived in 1582 by one Peter Morice a Dutchman, and are called *London-bridge water works*.

48
The Monument.

Near the north side of London bridge stands the *Monument*, a beautiful and magnificent fluted column of the Doric order, built with Portland stone, and erected in memory of the conflagration 1666. It was begun by Sir Christopher Wren in 1671, and finished by him in 1677. Its height from the pavement is 202 feet; the diameter of the shaft, or body of the column, is 15 feet; the ground-plinth, or lowest part of the pedestal, is 28 feet square; and the pedestal is 40 feet high. Over the capital is an iron balcony encompassing a cone 32 feet high, which supports a blazing urn of gilt brass. Within is a large staircase of black marble, containing 345 steps, each 10 inches and a half broad, and six inches thick. The west side is adorned with a curious emblem in alt-relief, denoting the destruction and restoration of the city. The first female figure represents London sitting in ruins, in a languishing posture, with her head dejected, her hair dishevelled, and her hand carelessly lying on her sword. Behind is *Time*, gradually raising her up: at her side is a woman touching her with one hand, whilst a winged sceptre in the other directs her to regard the goddesses in the clouds; one with a cornucopia, denoting *Plenty*; the other with the palm branch, the emblem of *Peace*. At her feet is a bee-hive, showing, that by industry and application the greatest misfortunes are to be overcome. Behind the figure of *Time* are citizens exulting at his endeavours to restore her; and beneath, in the midst of the ruins, is a dragon, who, as the supporter of the city arms, with his paw endeavours to preserve the same. Opposite to the city, on an elevated pavement, stands the king, in a Roman habit, with a laurel on his head, and a truncheon in his hand; and approaching her, commands three of his attendants to defend to her relief. The first represents the *Sciences* with a winged head and circle of naked boys dancing thereon; and holding *Nature* in her hand, with her numerous breasts, ready to give assistance to all. The second is *Architecture*, with a plan in one hand, and square and a pair of compasses in the other; and the third is *Liberty*, waving a hat in the air, showing her joy at the pleasing prospect of the city's speedy recovery. Behind the king stands his brother the duke of York, with a garland in one hand to crown the rising city, and a sword in the other for

her defence. The two figures behind are *Justice* and *Fortitude*; the former with a coronet, and the latter with a reined lion; and under the royal pavement lies *Envy*, gnawing a heart, and incessantly emitting pestiferous fumes from her mouth. On the plinth the reconstruction of the city is represented by builders and labourers at work upon houses. On the north, south, and east sides, are inscriptions relating to the destruction occasioned by the conflagration, the regulations about rebuilding the city, and erecting the monument; and round it is the following one:—"This pillar was set up in perpetual remembrance of the most dreadful burning of this Protestant city, begun and carried on by the treachery and malice of the Popish faction, in the beginning of September, in the year of our Lord 1666, in order to their carrying on their horrid plot for extirpating the Protestant religion and old English liberty, and introducing Popery and slavery." Dr Wendeborn, in his account of London, observes, that the monument, though not much above 100 years old, bears visible marks of decay already; and it will not probably be long before it must be pulled down. Some are of opinion that this is occasioned by the fault of the architect, others by the continual shaking of the ground by coaches; but the Doctor inclines to the latter opinion.

Eastward of the bridge and monument stands the *White Tower*, which gives name to another ward. It is the chief fortress of the city, and supposed to have been originally built by William the Conqueror. It appears, however, to have been raised upon the remains of a more ancient fortress, erected probably by the Romans: for in 1720, in digging on the south side of what is called *Cesar's Chapel*, there were discovered some old foundations of stone, three yards broad, and so strongly cemented that it was with the utmost difficulty they were forced up. The first work (according to Mr Pennant) seems to have been suddenly flung up in 1066 by the Conqueror, on his taking possession of the capital; and included in it a part of the ancient wall.

The great square tower, called the *White Tower*, was erected in the year 1078, when it arose under the directions of Gundulph bishop of Rochester, who was a great military architect. This building originally stood by itself. Fitzstephen gives it the name of *Arx Palatina*, "the Palatine Tower;" the commander of which had the title of Palatine bestowed on him. Within this tower is a very ancient chapel for the use of such of our kings and queens who wished to pay their devotion here. In 1092 a violent tempest did great injury to the Tower; but it was repaired by William Rufus and his successor. The first added another castellated building on the south side between it and the Thames, which was afterwards called *St Thomas's Tower*.

The Tower was first inclosed by William Longchamp, bishop of Ely and chancellor of England, in the reign of Richard I. This haughty prelate having a quarrel with John, third brother to Richard, under pretence of guarding against his designs, surrounded the whole with walls embattled, and made on the outside a vast ditch, into which, in after times, the water from the Thames was introduced. Different princes added other works. The present contents within the walls

London.

London.

walls are 12 acres and 5 rods, the circuit on the outside of the ditch 10½ feet. It was again inclosed with a mud-wall by Henry III. this was placed at a distance from the ditch, and occasioned the taking down part of the city-wall, which was refented by the citizens; who, pulling down this precinct of mud, were punished by the king with a fine of a thousand marks.

The *Lions Tower* was built by Edward IV. it was originally called the *Bulwark*, but received the former name from its use. A menagery had very long been a piece of regal state: Henry I. had his at his manor of Woodstock, where he kept lions, leopards, lynxes, porcupines, and several other uncommon beasts. They were afterwards removed to the Tower. Edward II. commanded the sheriffs of London to pay the keepers of the king's leopards sixpence a day for the sustenance of the leopards, and three halfpence a day for the diet of the keeper out of the fee-farm of the city. The royal menagery is to this day exceedingly well supplied.

In 1758 the Tower-ditch was railed all round. New barracks were some years ago erected on the Tower-wharf, which parts it from the river; and upon the wharf is a line of 61 pieces of cannon, which are fired upon state holidays. On this side of the Tower the ditch is narrow, and over it is a draw-bridge. Parallel to the wharf, within the walls, is a platform 70 yards in length, called the *Ladies Line*, because much fre-

quented by the ladies in the summer; it being shaded in the inside with a row of lofty trees, and without it is a delightful prospect of the shipping with boats passing and repassing on the river Thames. You ascend this line by stone steps, and being once upon it you may walk almost round the walls of the Tower without interruption.

The principal entrance into the Tower is by a gate to the west, large enough to admit coaches and heavy carriages; but these are first admitted through an outward gate, situated without the ditch upon the hill, and must pass a stout stone-bridge built over the ditch before they can approach the main entrance. There is, besides, an entrance near the very south-west corner of the Tower outward wall, for persons on foot, over the draw-bridge already mentioned to the wharf. There is also a water-gate, commonly called *Traitor's gate*, through which it has been customary to convey traitors and other state-prisoners to or from the Tower, and which is seldom opened on any other occasion; but the lords committed to the Tower in 1746 were publicly admitted at the main entrance. Over this gate is a regular building, terminated at each end by two round towers, on which are embrasures for pointing cannon. In this building there are the infirmary, the mill, and the water-works that supply the Tower with water.

In the Tower (the curiosities of which are more particularly described in the note (a), are a church, the

(a) In examining the curiosities of the Tower of London, it will be proper to begin with those on the outside of the principal gate. The first thing a stranger usually goes to visit is the wild beasts; which, from their situation, first present themselves: for having entered the outer gate, and passed what is called the spur-guard, the keeper's house presents itself before you, which is known by a painted lion on the wall, and another over the door which leads to their dens. By ringing a bell, and paying sixpence each person, you may easily gain admittance.

The next place worthy of observation is the Mint, which comprehends near one-third of the Tower, and contains houses for all the officers belonging to the coinage. On passing the principal gate you see the White Tower, built by William the Conqueror. This is a large, square, irregular stone building, situated almost in the centre, no one side answering to another, nor any of its watch-towers, of which there are four at the top, built alike. One of these towers is now converted into an observatory. In the first story are two noble rooms, one of which is a small armoury for the sea-service, it having various sorts of arms, very curiously laid up, for above 10,000 seamen. In the other room are many closets and presses, all filled with warlike engines and instruments of death. Over this are two other floors, one principally filled with arms; the other with arms and other warlike instruments, as spades, shovels, pick-axes, and chevaux de frize. In the upper story are kept match, sheep-skins, tanned hides, &c. and in a little room called Julius Cæsar's chapel, are deposited some records, containing perhaps the ancient usages and customs of the place. In this building are also preserved the models of the new-invented engines of destruction that have from time to time been presented to the government. Near the south-west angle of the White Tower is the Spanish armoury, in which are deposited the spoils of what was vainly called the Invincible Armada; in order to perpetuate to latest posterity the memory of that signal victory obtained by the English over the whole naval power of Spain in the reign of Philip II.

You are now come to the grand store-house, a noble building to the northward of the White Tower, that extends 245 feet in length and 60 in breadth. It was begun by king James II. who built it to the first floor; but it was finished by king William III. who erected that magnificent room called the New or Small Armoury, in which that prince, with queen Mary his consort, dined in great form, having all the warrant workmen and labourers to attend them, dressed in white gloves and aprons, the usual badges of the order of masonry. To this noble room you are led by a folding door, adjoining to the east end of the Tower chapel, which leads to a grand stair-case of 50 easy steps. On the left side of the uppermost landing-place is the work-shop, in which are constantly employed about 14 furnishers, in cleaning, repairing, and new-placing the arms. On entering the armoury, you see what they call a wilderness of arms, so artfully disposed, that at one view you behold arms for near 80,000 men, all bright, and fit for service; a sight which it is impossible to behold without astonishment; and beside those exposed to view, there were, before the late war, 16 chests

London. the offices of ordnance and of the mint, those of the keepers of the records, of the jewel-office, of the Spanish armoury, the horse armoury, and the new or small armoury; with barracks for the soldiers of the garrison, and handsome houses for several officers who reside here. The principal officers of the Tower are,
Vol. X. Part I.

a constable, a lieutenant, and a deputy-lieutenant. Besides London. the longing to this fortress are eleven hamlets; the militia of which, consisting of 400 men, are obliged, at the command of the constable of the Tower, to repair hither, and reinforce the garrison.

On Little Tower-hill is the *Vidualling-office* for the ⁴⁷ Vidualling navy. Office.

shut up, each chest holding about 1000 muskets. The arms were originally disposed by Mr Harris, who contrived to place them in this beautiful order, both here and in the guard chamber of Hampton-court. He was a common gunsmith; but after he had performed this work, which is the admiration of people of all nations, he was allowed a pension from the crown for his ingenuity.

Upon the ground floor, under the small armoury, is a large room of equal dimensions with that, supported by 20 pillars, all hung round with implements of war. This room, which is 24 feet high, has a passage in the middle 16 feet wide. At the sight of such a variety of the most dreadful engines of destruction, before whose thunder the most superb edifices, the noblest works of art, and numbers of the human species, fall together in one common and undistinguished ruin; one cannot help wishing that those horrible inventions had still lain, like a false conception, in the womb of nature, never to have been ripened into birth.

The horse armoury is a plain brick-building, a little to the eastward of the White Tower; and is an edifice rather convenient than elegant, where the spectator is entertained with a representation of those kings and heroes of our own nation, with whose gallant actions it is to be supposed he is well acquainted; some of them equipped and sitting on horseback, in the same bright and shining armour they were used to wear when they performed those glorious actions which gave them a distinguished place in the British annals.

You now come to the line of kings, which your conductor begins by reverting the order of chronology; so that in following them we must place the last first.

In a dark, strong stone room, about 20 yards to the eastward of the grand storehouse, or new armoury, the crown jewels are deposited. 1. The imperial crown, with which it is pretended that all the kings of England have been crowned since Edward the Confessor in 1042. It is of gold, enriched with diamonds, rubies, emeralds, sapphires, and pearls: the cap within is of purple velvet, lined with white taffety, turned up with three rows of ermine. They are, however, mistaken in showing this as the ancient imperial diadem of St Edward: for that, with the other most ancient regalia of this kingdom, was kept in the arched room in the cloisters in Westminster Abbey till the civil war; when, in 1642, Harry Martin, by order of the parliament, broke open the iron chest in which it was secured, took it thence, and sold it, together with the robes, sword, and sceptre, of St Edward. However, after the Restoration, king Charles II. had one made in imitation of it, which is that now shown. 2. The golden orb, or globe, put into the king's right hand before he is crowned; and borne in his left hand, with the sceptre in his right, upon his return into Westminster-hall after he is crowned. It is about six inches in diameter, edged with pearl, and enriched with precious stones. On the top is an amethyst, of a violet colour, near an inch and an half in height, set with a rich cross of gold, adorned with diamonds, pearls, and precious stones. The whole height of the ball and cup is 11 inches. 3. The golden sceptre, with its cross set upon a large amethyst of great value, garnished round with table diamonds. The handle of the sceptre is plain, but the pommel is set round with rubies, emeralds, and small diamonds. The top rises into a *fleur de lis* of six leaves, all enriched with precious stones, from whence issues a mound or ball, made of the amethyst already mentioned. The cross is quite covered with precious stones. 4. The sceptre, with the dove, the emblem of peace, perched on the top of a small Jerusalem cross, finely ornamented with table diamonds and jewels of great value. This emblem was first used by Edward the Confessor, as appears by his seal; but the ancient sceptre and dove was sold with the rest of the regalia, and this now in the Tower was made after the Restoration. 5. St Edward's staff, four feet seven inches and an half in length, and three inches three quarters in circumference, all of beaten gold, which is carried before the king at his coronation. 6. The rich crown of state, worn by his majesty in parliament; in which is a large emerald seven inches round; a pearl esteemed the finest in the world; and a ruby of inestimable value. 7. The crown belonging to his royal highness the prince of Wales. The king wears his crown on his head when he sits upon the throne; but that of the prince of Wales is placed before him, to show that he is not yet come to it. 8. The late queen Mary's crown, globe, and sceptre, with the diadem she wore at her coronation with her consort king William III. 9. An ivory sceptre, with a dove on the top, made for king James II.'s queen, whose garniture is gold, and the dove on the top gold enamelled with white. 10. The *curtana*, or sword of mercy, which has a blade of 32 inches long, and near two broad, is without a point, and is borne naked before the king at his coronation, between the two swords of justice, spiritual and temporal. 11. The golden spurs, and the armillas, which are bracelets for the wrists. These, though very antique, are worn at the coronation. 12. The *empulla*, or eagle of gold, finely engraved, which holds the holy oil the kings and queens of England are anointed with; and the golden spoon that the bishop pours the oil into. These are two pieces of great antiquity. The golden eagle, including the pedestal, is about nine inches high, and the wings expand about seven inches. The whole weighs about ten ounces. The head of the eagle screws off about the middle of the neck, which is made hollow, for holding the holy oil; and when the king is anointed by the bishop, the oil is poured into the spoon out of the bird's bill. 13. A rich

selfseller

London.

navy. It is separated from Tower-hill by a wall and gate, and contains houses for the officers, slaughter-houses, store-rooms, a brew-house, a salting-house, and a barrelling-house; under the direction of seven commissioners and other inferior officers.

48
Custom-house.

In Tower ward is also the *Custom house*, a large, handsome, and commodious building of brick and stone. It stands upon the bank of the Thames, and is accommodated with large wharfs, keys, and ware-houses. On this spot is the busy concourse of all nations, who pay their tribute towards the support of Great Britain. About the year 1559, the loss to the revenue, by collecting it in different parts of the city, was first discovered, and an act passed to compel people to land their goods in such places as were appointed by the commissioners of the revenue; and this was the spot fixed on: A custom-house was erected; which, being destroyed by the great fire, was rebuilt by Charles II. In 1718 it underwent the same fate, and was restored in its present form. Before the custom-house was established here, the principal place for receiving the duties was at Billingsgate. In 1268 the half year's customs for foreign merchandise in the city of London came only to £.75:6:10; the annual produce of the customs, ending in April 1789, amounted to £.3,711,126.

49
Trinity House.

In Water-lane, a little to the north-west of the custom-house, is the *Trinity-house*; a society founded in 1515, at a period in which the British navy began to assume a system. The founder was Sir Thomas Spert comptroller of the navy, and commander of the great ship Henry Grace de Dieu. It is a corporation, consisting of a master, four wardens, eight assistants, and eighteen elder brethren; selected from commanders in the navy and the merchants service; and now and then a compliment is paid to one or two of our first nobility. They may be considered as guardians of our ships, military and commercial. Their powers are very extensive: they examine the ma-

thematical children of Christ's hospital, and the masters of his majesty's ships; they appoint pilots for the river Thames; settle the general rates of pilotage; erect light-houses and sea-marks; grant licences to poor seamen, not free of the city, to row on the Thames; prevent foreigners from serving on board our ships without licence; punish seamen for mutiny and desertion; hear and determine complaints of officers and men in the merchants service, but liable to appeal to the judge of the court of admiralty; superintend the deepening and cleansing of the river Thames, and have under their jurisdiction the ballast-office; have powers to buy lands, and receive donations for charitable uses; and, in consequence, relieve annually many thousands of poor seamen, their widows, and orphans. It is in this house the business of the institution is carried on: but the mother-house is at Deptford, the corporation being named, "the master, wardens, and assistants of the guild or fraternity of the most glorious and undivided Trinity, and of St Clement, in the parish of Deptford Strand, in the county of Kent."

Between Aldgate and the Tower is the street called ⁵⁰the *Minories*, from some poor ladies of the order of nuns.

St Clare, or minoresse. They had been invited to London by Blanch queen of Navarre, and wife to Edmund earl of Lancaster, who founded a convent for them in 1293. On the suppression of the monasteries, it was converted into a dwelling-house for some of the nobility, and is now in the possession of the Dartmouth family. Till of late years, the Minories were but a despicable street; but have now been excellently rebuilt, and are as elegant as any in the city.

On the west side of the city-walls at this place, stood the house of the *Crutched or Crossed Friars*, an order instituted at Bologna in 1169, and of which a branch settled in England in 1244, where they were accommodated with an house in this place by two citizens named *Ralph Hofer* and *William Saberna*, who became members.

half-crown of state, in form like the square White Tower, and so exquisitely wrought, that the workmanship of modern times is in no degree equal to it. It is of gold, and used only on the king's table at the coronation. 14. A noble silver font, double gilt, and elegantly wrought, in which the royal family are christened.

15. A large silver fountain, presented to king Charles II. by the town of Plymouth, very curiously wrought; but much inferior in beauty to the above. Besides these, which are commonly shown, there are in the jewel office all the crown jewels worn by the princes and princesses at coronations, and a great variety of curious old plate.

The record office consists of three rooms, one above another, and a large round room, where the rolls are kept. These are all handsomely waincotted, the waincoat being framed into presses round each room, within which are shelves and repositories for the records; and for the easier finding of them, the year of each reign is inscribed on the inside of these presses, and the records placed accordingly. Within these presses, which amount to 56 in number, are deposited all the rolls, from the first year of the reign of king John to the beginning of the reign of Richard III. but those after this last period are kept in the Rolls Chapel. The records in the Tower, among other things, contain the foundation of abbeys and other religious houses; the ancient tenures of all the lands in England, with a survey of the manors; the original of laws and statutes; proceedings of the courts of common law and equity; the rights of England to the dominion of the British seas; leagues and treaties with foreign princes; the achievements of England in foreign wars; the settlement of Ireland, as to law and dominion; the forms of submission of some Scottish kings for territories held in England; ancient grants of our kings to their subjects; privileges and immunities granted to cities and corporations during the period above mentioned; enrolments of charters and deeds made before the Conquest; the bounds of all the forests in England, with the several respective rights of the inhabitants to common pasture, and many other important records, all regularly disposed, and referred to in near a thousand folio indexes. This office is kept open, and attendance constantly given, from seven o'clock till one, except in the months of December, January, and February, when it is open only from eight to one, Sundays and holidays excepted. A search here is half a guinea, for which you may peruse any one subject a year.

Taehdon.
51
India Com
pany's
Warehouses

members of their order. Henry VIII. granted their house to Sir Whomas Wyatt the elder, who built a handsome mansion on part of the ground where it stood. This mansion became afterwards the residence of John Lord Lumley, a celebrated warrior in the time of Henry VIII. In process of time, it was converted into a navy-office: but this office being removed to Somerset-house, the India Company have erected in its place a most magnificent warehouse, in form of an oblong square of about 250 feet by 160, including a court of 150 by 60 feet, the entrance to which is by an arched gateway.

52
Billinggate
Billinggate ward is distinguished by its market. *Billinggate* was a small port for the reception of shipping, and for a considerable time the most important place for the landing of almost every article of commerce. In the time of King William, Billinggate began to be celebrated as a fish-market. In 1699 it was by act of parliament made a free port for fish to be sold there every day except Sunday; but Mr Pennant informs us, that the object of this has long been frustrated, and that fish are now no longer to be had there in perfection. The same author gives a list of the fish which in the time of Edward III. were brought to the London market; the monarch himself having confederated to regulate the prices, that his subjects might not be imposed upon by those who sold them. Among these were the conger-eel and porpoise, neither of which is now admitted to any table. A pike at that time cost 6s. 8d.; whence our author concludes, that it was an exotic fish, and brought over at a vast expence. Some fishes are mentioned in his list with which this naturalist owns himself unacquainted, *viz.* the *barkey, bran, barleie, cropling, and rumb*. In Archbishop Nevill's great feast is mentioned also a fish named *thirle-poele*, unknown at present. Seals were formerly accounted a fish; and these, together with the sturgeon and porpoise, were the only fresh fish permitted by the 33d of Henry VIII. to be bought of any stranger at sea between England, France, Flanders, and Zealand.

53
Leadenhall.
Limestreet ward is remarkable for a very large building, of great antiquity, called *Leadenhall*, with flat battlements leaded on the top, and a spacious square in the middle. In 1309 it was the house of Sir Hugh Nevil knight; in 1384, of Humphry Bohun Earl of Hereford; in 1408 it became the property of the celebrated Whittington, who presented it to the mayor and commonalty of London; and in 1419, a public granary was erected here by Sir Simon Eyre, a citizen and draper, who built it with stone in its present form. This granary was designed as a preservative against famine, and to be kept always full of corn, which design was for some time happily answered. The house came to be used for many other purposes besides that of a granary; as for keeping the artillery and arms of the city. Preparations for any kind of pageantry or triumph were also made here; and from its strength the place was considered as the chief fortrefs within the city in case of any popular insurrection, and was likewise the place from whence alms were distributed. In this edifice are warehouses for the sale of leather, Col-

London.
54
The Index
House.

chester baize, meal, and wool. Adjoining to Leadenhall is a market, thence called *Leadenhall market*, consisting of five considerable squares or courts, and reckoned one of the greatest markets in Europe for flesh and other provisions, as well as for leather, green hides, and wool. A little to the eastward is the *India-house*, built in 1726, on the spot occupied by Sir William Craven, mayor in 1610. According to Mr Pennant, this house "is not worthy of the lords of Indostan."

In Broadstreet is the *Bank of England*, a stone building, which occupies one side of Three-needle street. The centre, and the building behind, were founded in the year 1733; the architect George Sampson. Before that time the business was transacted in Grocers-hall. The front is a sort of vestibule; the base rustic, the ornamental columns above Ionic. Within is a court leading to a second elegant building, which contains a hall and offices, where the debt of above 250 millions is punctually discharged. Of late years two wings of uncommon elegance, designed by Sir Robert Taylor, have been added, at the expence of a few houses, and of the church of St Christopher's le Stocks. "The name of the projector of this national glory (says Mr Pennant), was Mr James Paterson of Scotland. This palladium of our country was in 1780 saved from the fury of an infamous banditti by the virtue of its citizens, who formed suddenly a volunteer company, and over-awed the miscreants; while the chief magistrate skulked, trembling in his mansion-house, and left his important charge to its fate. This important building has ever since been very properly guarded by the military; who, in passing through the city, have often given offence to many busy characters who would strive to preserve the city rights at the expence of the national destruction. A lord mayor was the last who interested himself by applying to Mr Grenville, who gave him to understand, that if the guards were not quietly permitted to discharge their duty, the bank would be removed to Somerset-house."

56
Mer-
chant-
Taylors
Hall, &c.
At the extremity of Three-needle street is *Mer-merchant-Taylors Hall*. In this street also is the *South-Sea House*, first established in 1711 for the purpose of an exclusive trade to the South Sea, and for supplying Spanish America with negroes.

Near the junction of Throgmorton street with Broad-street stood a magnificent house built by Cromwell earl of Essex; after whose fall, the house and gardens were bought by the Drapers company. The house was destroyed in the great fire, but rebuilt for the use of the company in a magnificent manner.

57
St Giles's
church
Mr Pennant informs us, that *St Giles's church* in the *St Giles's* fields, and a few houses to the west of it, in the year 1600, was barely separated from Broad-street. The church is supposed to have belonged to an hospital for lepers, founded about the year 1117, by Matilda queen to Henry I. In ancient times it was customary here to present to malefactors, on their way to the gallows (which, about the year 1413, was removed from Smithfield, and placed between St Giles's high-street and Hog-lane (c), a great bowl of ale, as the last refreshment they were to receive in this life. On

(c) This late place of execution, according to Mr Pennant, was called in the time of Edward III. when the

London. the door to the church-yard is a curious piece of sculpture, representing the last day, containing an amazing number of figures, set up about the year 1686. This church was rebuilt in 1625. By the amazing raising of the ground by filth and various adventitious matter, the floor in the year 1730 was eight feet below the surface acquired in the intervening time. This alone made it necessary to rebuild the church in the present century. The first stone was laid in 1730; it was finished in 1734, at the expence of 10,000*l*.—In the church-yard is a great square pit, with many rows of coffins piled one upon the other, all exposed to sight and smell, the latter of which is highly offensive if not dangerous.

On the west side of Broad-street stood the house of the Augustines, founded by Humphrey Bohun Earl of Somerset in 1253, for friars and hermits of the Augustine order. On the dissolution of the monasteries, great part of the house was granted to William Lord St John, afterwards Marquis of Winchester, and Lord Treasurer, who founded a magnificent house named *Winchester-house*. The west end of the church was granted in 1551 to John a Laico for the use of the Germans and other fugitive Protestants, and afterwards to the Dutch as a place for preaching. A part of it was also converted into a glass-house for Venice glass, in which the manufacture was carried on by artists from that city, and patronised by the Duke of Buckingham. The place was afterwards converted into *Pinners-hall*, belonging to the company of pin-makers.

To the eastward of Winchester-street stood the house of that very eminent merchant Sir Thomas Gresham, afterwards known by the name of *Gresham college*: (See GRESHAM.) It has been pulled down not many years ago; and the *Excise Office*, a most magnificent and at the same time simple building, rose in its place. Mr Pennant informs us, that from the 5th of January 1786 to January 5th 1787, the payments into this office amounted to no less than *L*.5,531,114 : 6 : 10*l*.

The *Royal Exchange*, which is the meeting-place of the merchants of London, stands in the ward of Cornhill, and is the finest and strongest fabric of the kind in Europe. It was founded in the year 1566. Sir Thomas Gresham, merchant in London, made an offer to the lord mayor and citizens, to build, at his own expence, a commodious edifice for merchants to meet and transact business, provided the city would find him a convenient situation for the same. Mr Pennant informs us, that one Richard Clough a Wellman, originally Sir Thomas's servant, first put him on this design by a letter from Antwerp, in which he reproached the London merchants with having no place to transact their business, but walking about in the rain, more like pedlars than merchants. The ci-

zens, in compliance with Sir Thomas's desire, purchased, for the sum of *L*.3532, 80 houses in the two alleys called *New St Christopher's*, and *Swan-alley*, leading out of Cornhill into Three-needle street. The materials of those houses were sold for *L*.478, and the ground, when cleared, was conveyed to Sir Thomas Gresham, who, accompanied by several aldermen, laid the first brick of the new building on the 7th of June that year. Each alderman also laid his brick, and left a piece of gold for the workmen; who set about it with such assiduity and resolution, that the whole fabric was roofed by the month of November 1567, and was soon after completed under the name of the *Burse*. This building was totally destroyed by the fire in 1666; and in its place the present magnificent structure was erected at the expence of *L*.80,000, which stands upon a plat of ground 203 feet in length and 171 in breadth, containing an area in the middle, of 61 square perches, surrounded with a substantial and regular stone building, wrought in rustic. It has two fronts, north and south, each of which is a piazza; and in the centre are the grand entrances into the area, under a very lofty and noble arch. The south-front in Cornhill is the principal; on each side of which are Corinthian demi-columns, supporting a compass pediment; and, in the intercolumniation on each side, in the front next the street, is a niche, with the statues of King Charles I. and II. in Roman habits, and well executed. Over the aperture, on the cornice between the two pediments, are the king's arms in relief: on each side of this entrance is a range of windows placed between demi-columns, and pilasters of the composite order, above which runs a balustrade. This building is 56 feet high: and from the centre, in this front, rises a lantern and turret 178 feet high, on the top of which is a fan of gilt brass made in the shape of a grasshopper, the crest of Sir Thomas Gresham's arms. The north front in Three-needle-street is adorned with pilasters of the composite order; but has neither columns nor statues on the outside; and has triangular, instead of compass, pediments. The inside of the area is also surrounded with piazzas, forming ambulatories for merchants, &c. to shelter themselves from the weather, when met there upon business. Above the arches of this piazza is an entablature with curious ornaments; and on the cornice a range of pilasters with an entablature extending round, and a compass pediment in the middle of the cornice of each of the four sides. Under the pediment on the north side are the king's arms; and the south, the city's arms; on the east, Sir Thomas Gresham's arms; and on the west, the mercer's arms, with their respective enrichments. In these intercolumns are 24 niches, 20 of which are filled with the statues of the kings and queens of England.

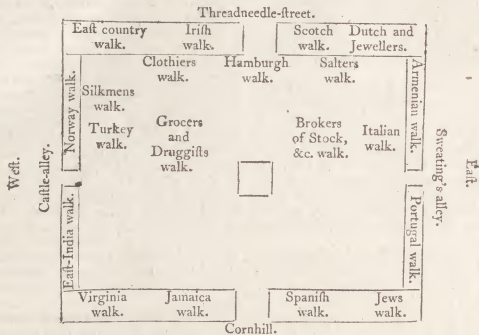
the gentle Mortimer finished his days here, the *Elms*: but the original as well as the present name was *Ty-bourne*; not from *tye* and *burn*, as if it were called so from the manner of capital punishments; but from *bourne*, the Saxon word for a "brook," and *Tye* the name of that brook, which joined gave name to a manor before the conquest. Here was also a village and church denominated *St John the Evangelist*, which fell to decay, and was succeeded by that of *Mary bourne*, corrupted into *Mary-la-bonne*. In 1626, Queen Henrietta Maria was compelled by her priests to take a walk by way of penance to Tyburn. What her offence was we are not told; but Charles was so disgusted at this insolence, that he soon after sent them and all her majesty's French servants out of the kingdom.

London. land. Under these piazzas, within the area, are 28 niches, all vacant but that in which Sir Thomas Gresham's statue is placed in the north-west angle, and that in the fourth-west, where the statue of Sir John Barnard was placed in his lifetime by his fellow-citizens to express their sense of his merit. The centre of this area also is ornamented with a statue of King Charles II. in a Roman habit, standing upon a marble pedestal about eight feet high, and encompassed with iron rails; which pedestal is enriched on the south side with an imperial crown, a sceptre, sword, palm-branches, and other decorations, with a very flattering inscription to the king. On the west side is a cupid

cut in relievo, resting his right hand on a shield with the arms of France and England quartered, and holding a rose in his left hand. On the north side is another cupid supporting a shield with the arms of Ireland; and on the east side are the arms of Scotland, with a cupid holding a thistle; all done in relievo: the whole executed by that able statuary Mr Gibbon.

In this area, merchants, and such as have business with them, meet every day at change hours; and for the more regular, and readier dispatch of business, they dispose of themselves into separate walks, according to the following plan.

North.



In building this expensive structure there was an eye not only to magnificence, and to accommodate the merchants, but also to reimburse the expence. For this reason a gallery was built over the four sides of the royal exchange. This was divided into 200 shops, which were let out to haberdashers, milliners, &c. and which for several years were well occupied. But these shops have now for a long time been deserted, and the galleries are let out to the Royal Exchange Assurance-office, the Merchant-seamens office, the Marine Society, and to auctioneers, &c. Under the whole area there are the finest dry vaults that can be found any where, which are let out to the East India company to deposit their pepper. In the turret is a good clock with four dials, which is well regulated ever day, so that it becomes a standard of time to all the mercantile part of the town; and it goes with chimes at three, six, nine, and twelve o'clock, playing upon twelve bells. The outside of this grand fabric suffers very much in its elegance from the shops that surround it, and are built within its walls; and which are occupied by bookbinders, toy-men, cutlers, hosiery, watch-makers, &c.

South of the Royal-exchange, and near the west extremity of Lombard-street, is the *General Post Office*, which is a handsome and commodious building.

In Walbrook ward is the *Mansion-house*, for the residence of the lord-mayor. This edifice was begun in 1739, and finished in 1753. It is built of Portland stone, with a portico of six fluted columns, of the Corinthian order, in the front. The basement story is very massy, and consists of rustic work; in the centre of it is the door, which leads to the kitchens, cellars, and other offices. On each side rises a flight of steps, leading up to the portico, in the middle of which is the principal entry. The stone balustrade of the stairs is continued along the front of the portico, and the columns support a large angular pediment, adorned with a group of figures in bas relief, representing the dignity and opulence of the city of London. It is an extreme heavy building, of an oblong form, and its depth is the long side, having several magnificent apartments, which are not, however, well lighted, on account of the houses that surround it.

Behind the mansion-house is *St Stephen's church*, in Walbrook, justly reputed the master-piece of the celebrated Sir Christopher Wren, and is said to exceed every modern structure in the world in proportion and elegance.

The mansion-house, and many adjacent buildings, stand on the place where the *Stock market* once stood. This took its name from a pair of stocks erected

London. ted near the spot in 1281; and was the great market of London for provisions during many centuries.

65 London-tion. In this ward is situated one of the most remarkable pieces of antiquity in London. It is a great stone, now standing in a cave on the north side of Canon-street, close under the fourth wall of St Swithin's church. It is called *London-stone*; and was formerly pitched edgewise on the other side of the street, opposite to where it now stands, fixed deeply in the ground, and strongly fastened with iron bars; but for the convenience of wheel-carriages it was removed to its present situation. This stone is mentioned so early as the time of Athelstan, king of the West Saxons, and has been carefully preserved from age to age. Of the original cause of its erection no memorial remains; but it is conjectured, that as London was a Roman city, this stone might be the centre, and might serve as an object from which the distance was computed to the other considerable cities or stations in the province.

66 Merchant-Tailors School. In Dowgate ward is a noted academy, called *Merchant-tailors School*, from its having been founded by the merchant-tailors company, in the year 1561. It was destroyed by the fire of London in 1666, but was rebuilt, and is a very large structure, with commodious apartments for the masters and ushers, and a fine library. Sir Thomas White, lord mayor of this city, having founded St John's college in Oxford in 1557, appointed this school as a seminary for it, and established at Oxford 46 fellowships for scholars elected from this school.

67 St Mary le Bow. The church of *St Mary le Bow*, in Cordwainers-street ward, is the most eminent parochial church in the city. It was originally built in the reign of William the Conqueror; and being the first church the steeple of which was embellished with stone arches or bows, took thence its denomination of *le Bow*. It was burnt down in the fire of 1666, but soon afterwards rebuilt. The steeple of this church is reckoned the most beautiful of its kind in Europe.

68 Guildhall. In Cheap ward is *Guildhall*, or the town-house of London. This was originally built in 1411, but so damaged by the great fire already mentioned, as to be rebuilt in 1669. The front has a Gothic appearance; and this character is also due to the two gigantic effigies which stand within the hall. The hall is 153 feet long, 50 broad, and 55 high, adorned with the royal arms, and those of the city and its companies, as well as with several portraits of English sovereigns and judges. In this building are many apartments for transacting the business of the city, besides one for each of the judicial courts, namely, that of the King's Bench, the Common-Pleas, and the Exchequer.

69 Cheap-side. In the year 1246 Cheapside was an open field, named *Crown-field*, from an inn with the sign of the crown. At that time, and even for 200 years afterwards, none of the streets of London were paved excepting Thames-street, and from Ludgate-hill to Charing-Cross.

70 Goldsmiths Hall. *Goldsmiths Hall* stands in Foster-lane, which opens into the west end of Cheap-side.—In this lane also is St Martin's le Grand, which, though surrounded by the city, was yet subject, near three centuries, to Westminster-Abbey. A fine college was built here

in 700 by Wythred king of Kent; and, about the year 1056, rebuilt and chiefly endowed by Ingelric and Edward, two noble brothers. In 1068, it was confirmed and made independent of every other ecclesiastical jurisdiction, even that of the pope himself not excepted; and its privileges were confirmed by succeeding monarchs. It was governed by a dean, and a number of secular canons. In this jurisdiction a magnificent church was erected, but pulled down in 1548, when the college was surrendered; after which a tavern was erected on the spot.

A little to the westward of Mary-le-Bow church The Cross (in the adjoining ward), stood the *Croft* and *Conduit* in the middle of the street. The former was built by Edward I. in 1290, in memory of his queen Eleanor, whose body was refted on that spot in its way to be buried. Originally it had the statue of the queen at full length, resembling exactly that at Northampton. Having at length fallen to decay, it was rebuilt in 1441 by John Hutherby mayor of the city, at the expense of several citizens, being now ornamented with various images, as those of the Resurrection, the Virgin Mary, &c. As the magnificent processions took this road, it was new-gilt at every public entry. After the Reformation, the images gave so much offence, that it was thought proper to substitute that of Diana in place of the Virgin Mary. This, however, was refted by Queen Elizabeth, who offered a reward for the discovery of the offenders. As she imagined that a cross, the symbol of the Christian religion, could not justly give offence to any professor of that religion, she ordered a cross to be placed on the summit, and gilt; but in 1643, the parliament ordered the demolition of all crosses and other marks of Romish superstition.

Splendid tournaments were held between the Cross and Sopers-lane in the year 1331; but as Queen Philippa and a great number of other ladies, dressed in rich attire, were sitting on the upper scaffolding to behold the sports, the feat gave way, and they suddenly fell down among the knights and others who stood below; many of whom were grievously hurt. The carpenters were saved from punishment by the intercession of the queen; but the king, to prevent accidents of the like nature, ordered a building of stone to be erected near Bow-church, from whence the queen and other ladies might behold such spectacles in safety. This was used for the same purpose till the year 1410, when Henry IV. granted it to certain mercers, who converted it into shops, warehouses, and other places necessary for their trade.

A small distance eastward from the Cross stood the Conduit, which served to fill the lesser ones with water brought by pipes from Paddington.—This stood on the spot where the old conduit was situated, which was founded in 1285, constructed of stone lined with lead, and rebuilt in 1479 by Thomas IIan one of the sheriffs. On some grand occasions, these conduits have been made to run with claret; as at the coronation of Anna Bullen.

On the north side of Cheapside stood the *Hospital* of *St Thomas of Acon*, founded by Fitz-Theobald de Hall. Helles, and his wife Agnes, sister to the famous Thomas à Becket. The hospital was built 20 years after the murder of Thomas; and such was his reputation

London.

for sanctity, that it was dedicated to him even before he was canonized, and that in conjunction with the Virgin Mary herself. The whole was granted by king Henry VIII. to the company of mercers. It was destroyed by the great fire in 1666; but rebuilt by the mercers company, who have their hall here.—Immediately to the east is a narrow street called the *Old Jewry*, which took its name from a great synagogue which stood here till the Jews were expelled the kingdom in 1291. After them an order of friars named *Frates de sacca*, or *de penitentia*, took possession of the synagogue; and in 1305, Robert Fitzwalter, the great banner-bearer of the city, requested that the friars might assign it to him; the reason of which probably was, that it stood near to his house, which was situated in the neighbourhood of the present Grocers-hall. The chapel was bought by the grocers from Fitzwalter in 1411 for 320 marks.

75
Blackwell
Hall.

In Blackwell or Basing-hall ward, is *Blackwell or Bakeswell hall*, which adjoins to Guildhall, and is the greatest mart of woollen cloth in the world. It was purchased of King Richard II. by the city; and has ever since been used as a weekly market for broad and narrow woollen cloths, brought out of the country. Formerly proclamations were issued to compel people to bring their goods into the hall, to prevent deceit in the manufactures, which might be productive of discredit in foreign markets, and likewise be the means of defrauding the poor children of Christ's hospital of part of the revenue which arose from the hallage of this great magazine. It suffered the general devastation in 1666; but was rebuilt in 1672, and is now a spacious edifice, with a stone front adorned with columns.

76
Sion College

Cripplegate-ward is remarkable for a college, called *Sion-college*, founded in 1627, on the site of Elsing-hospital (d) or priory, by Dr Thomas White vicar of St Dunstan's in the West, for the improvement of the London clergy; and with alms-houses, under their care, for 20 poor persons, 10 men and 10 women. In the year 1631, a charter was procured for incorporating the clergy of London, by which they were constituted fellows of the college; and out of the incumbents are annually elected, on Tuesday three weeks after Easter, a president, two deans, and four assistants, who are to meet quarterly, to hear a Latin sermon, and afterwards be entertained at dinner in the college-hall at the expence of the foundation. John Simpson rector of St Olaves, who superintended the building, added, at his own expence, for the use of the studious part of the London clergy, a library 120 feet long, and amply filled with books.

77
Barbers
Hall.

In this ward is a hall which belongs to the company of barber-surgeons, the professions of barber and surgeon being formerly exercised by the same person. It was built by the celebrated Inigo Jones, and the upper end is formed out of one of the towers or barbicans of London wall. The anatomical theatre is elliptical, and very finely contrived. This hall is now called *Barbers Hall*; the surgeons, who disdained to be

any longer associated with their ancient brethren, having obtained a separate charter, and built themselves a new hall in the Old Bailey.

London.

78
St Paul's
Cathedral.

Farringdon-ward Within, is distinguished by the most magnificent Protestant church in the world, the cathedral of *St Paul*. The best authority we have for the origin of this church, is from its great restorer Sir Christopher Wren. His opinion that there had been a church on this spot, built by the Christians in the time of the Romans, was confirmed: when he searched for the foundations for his own design, he met with those of the original *presbyterium*, or semicircular chancel, of the old church. They consisted only of Kentish rubble-stone, artfully worked, and consolidated with exceedingly hard mortar, in the Roman manner, much excelling the superstructure. He explodes the notion of there having been here a temple of Diana, and the discovery of the horns of animals used in the sacrifices to that goddess, on which the opinion had been founded, no such having been discovered in all his searches.

The first church is supposed to have been destroyed in the Dioclesian persecution, and to have been rebuilt in the reign of Constantine. This was again demolished by the pagan Saxons; and restored, in 603, by Sebert, a petty prince, ruling in these parts, under Ethelbert king of Kent, the first Christian monarch of the Saxon race; who, at the instance of St Augustine, appointed Melitus the first bishop of London. Erkenwald, the son of king Offa, fourth in succession from Melitus, ornamented his cathedral very highly, and improved the revenues with his own patrimony. He was most deservedly canonized: for the very litter, in which he was carried in his last illness, continued many centuries to cure fevers by the touch; and the very chips, carried to the sick, restored them to health!

When the city of London was destroyed by fire, in 1086, this church was built; the bishop Mauritius began to rebuild it, and laid the foundations, which remained till its second destruction, from the same cause, in the last century. Notwithstanding Mauritius lived twenty years after he had begun this pious work, and bishop Beaugaves enjoyed the see twenty more, yet such was the grandeur of the design, that it remained unfinished. The first had the ruins of the Palatine Tower bestowed on him, as materials for the building; and Henry I. bestowed on Beaugaves part of the ditch belonging to the Tower, which, with purchases made by himself, enabled him to inclose the whole with a wall. The same monarch granted, besides, that every ship which brought stone for the church, should be exempted from toll; he gave him also all the great fish taken in his precincts, except the tongues; and, lastly, he secured to him, and his successor the delicious tythes of all his venison in the county of Essex.

The style of the ancient cathedral was a most beautiful Gothic; over the east end was an elegant circular window; alterations were made in the ends of the

(d) This was founded by William Elsing mercer in 1329 (on the site of a decayed nunnery), for the support of 100 blind men. He afterwards changed it into a priory, and became himself the first prior, who with four canons-regular were to superintend the miserable objects.

London.

the two transepts, so that their form is not delivered down to us in the ancient plans; and from the central tower rose a lofty and most graceful spire. The dimensions, as taken in 1309, were these: The length six hundred and ninety feet; the breadth a hundred and twenty; the height of the roof of the west part, from the floor, one hundred and two; of the east part, a hundred and eighty-eight; of the tower, two hundred and sixty; of the spire, which was made of wood covered with lead, two hundred and seventy-four. The whole space the church occupied was three acres and a half, one rood and a half, and six perches.

We may be astonished at this amazing building, and naturally inquire what fund could supply money to support so vast an expence. But monarchs resigned their revenues resulting from the customs due for the materials, which were brought to the adjacent wharfs; they furnished wood from the royal forests: prelates gave up much of their revenues; and, what was more than all, by the pious bait of indulgences, and remissions of penance, brought in from the good people of this realm most amazing sums. Pope Innocent III. in 1257, gave a release of sixty days penance; the archbishop of Cologne gave, a few years before, a relaxation of fifty days; and Boniface, archbishop of Canterbury, forty days.

The high altar dazzled with gems and gold, the gifts of its numerous votaries. John king of France, when prisoner in England, first paying his respects to St Erkenwald's shrine, offered four basons of gold: and the gifts at the obsequies of princes, foreign and British, were of immense value. On the day of the conversion of the tutelary saint, the charities were prodigious, first to the souls, when an indulgence of forty days pardon was given, *vere penitentibus, contritis et confessis*; and, by order of Henry III. fifteen hundred tapers were placed in the church, and fifteen thousand poor people fed in the church-yard.

The holiness of this place did not prevent thieves and profligates of all denominations from lurking within the precincts, and committing, under the favour of the night, murders and every sort of crime. Edward I.

N 187.

gave the dean and canons permission to inclose the whole within a wall; and to have gates to be shut every night, to exclude all disorderly people. Within these walls, on the north-west side, was the bishop's palace. Froissart tells us, that after the great tournament in Smithfield, king Edward III. and his queen lodged here, on occasion of their nuptials (æ.) — In 1561, the noble spire was totally burnt by lightning, and never restored.

In consequence of the resolutions taken in 1620, by James I. to repair the cathedral, the celebrated Inigo Jones was appointed to the work. But it was not attempted till the year 1633, when Inigo laid the first stone, and Inigo the fourth. That great architect begun with a most notorious impropriety, giving to the west end a portico of the Corinthian order, beautiful indeed, to this ancient gothic pile; and to the ends of the two transept gothic fronts in a most horrible style. The great fire made way for the restoring of this magnificent pile in its present noble form by Sir Christopher Wren, an architect worthy of so great a design.

It is built of fine Portland stone, in form of a cross. On the outside are two ranges of pilasters, consisting of an hundred and twenty each; the lower range of the Corinthian order, and the upper of the composite. The spaces between the arches of the windows and the architrave of the lower order, are filled with a great variety of curious enrichments, as are also those above. On the north side is a portico, the ascent to which is by twelve steps of black marble, and its dome supported by six very large columns. Over the dome is a pediment, the face of which is engraved with the royal arms, regalia, and other ornaments. On the south is a portico, the ascent to which is by twenty-five steps, and its dome supported by six columns, corresponding with those on the north side. The west front is graced with a most magnificent portico, supported by twelve lofty Corinthian columns: over these are eight columns of the composite order, which support a noble pediment, crowned with its acroteria, and in this pediment is the history of St Paul's conversion, boldly carved in bas relief. The ascent to this portico

3

is

(E) Before this cathedral was the famous *Paul's Cross*, a pulpit formed of wood, mounted upon steps of stone, and covered with lead, in which the most eminent divines were appointed to preach every Sunday in the forenoon. To this place, the court, the mayor, and aldermen, and principal citizens, used to resort. The greatest part of the congregation sat in the open air; the king and his train had covered galleries; and the better sort of people were also protected from the injury of the weather; but the far greater part stood exposed in the open air: for which reason the preacher went in very bad weather to a place called the Shrouds; a covered space on the side of the church, to protect the congregation in inclement seasons. Considerable contributions were raised among the nobility and citizens, to support such preachers as were (as was often the case) called to town from either of the universities. In particular, the lord mayor and aldermen ordered that every preacher, who came from a distance, should be freely accommodated, during five days, with sweet and convenient lodgings, fire, candle, and all necessaries. And notice was given by the bishop of London, to the preacher appointed by him, of the place he was to repair to.

We hear of this being in use as early as the year 1259. It was used, as Mr Pennant observes, not only for the instruction of mankind by the doctrine of the preacher, but for every purpose political or ecclesiastical; for giving force to oaths, for promulging of laws, or rather the royal pleasure, for the emission of papal bulls, for anathematizing sinners, for benedictions, for exposing of penitents under censure of the church, for recantations, for the private ends of the ambitious, and for the defaming of those who had incurred the displeasure of crowned heads.

It was demolished in 1643 by order of parliament, executed by the willing hands of Isaac Pennington, the fanatical lord mayor of that year, who died in the Tower a convicted regeicide.

London. is by a flight of steps of black marble, extending the whole length of the portico; and over each corner of the west front is a beautiful turret. A vault dome, or cupola, rises in the centre of the building. Twenty feet above the roof of the church is a circular range of thirty-two columns with niches, placed exactly against others within. These are terminated by their entablature, which supports a handsome gallery, adorned with a stone ballustrade. Above the columns last mentioned is a range of pilasters, with windows between them: and from the entablature of these, the diameter of the dome gradually decreases. On the summit of the dome is an elegant balcony, from the centre of which runs a beautiful lanthorn, adorned with Corinthian columns. The whole is crowned with a copper ball, supporting a cross, both finely gilt. Within, the cupola stands on eight stupendous pillars, curiously adorned: the roof of the choir is supported by fix pillars, and that of the church by two ranges, consisting of twenty more. The roof of the church and choir is adorned with arches and spacious peripheries of enrichments, admirably carved in stone. Quite round the inside of the cupola, there is a whispering iron balcony, or gallery, the top of which is richly painted by Sir James Thornhill.

The first stone of this superb edifice was laid on June 21, 1675; and the building was completed in 1710; but the whole decorations were not finished till 1723. It was a most singular circumstance, that, notwithstanding it was 35 years in building, it was begun and finished by one architect, and under one prelate Henry Compton bishop of London. The church of St Peter's was 135 years in building, in the reigns of 19 popes, and went through the hands of twelve architects. It is not, as often mistaken, built after the model of that famous temple: it is the entire conception of our great countryman, and has been preferred in some respects, by a judicious writer, to even the Roman Basilica. Its dimensions are less. The comparative view is given in the Parentalia, and copied in London and its Environs. The height of St Peter's, to the top of the cross, is 437 feet and an half; that of St Paul's 340 feet; so that, from its situation, it is lofty enough to be seen from the sea. The length of the first is 729 feet; of the latter, 500. The greatest breadth of St Peter's is 364; of St Paul's, 180.

In the reigns of James I. and Charles I. the body of this cathedral was the common resort of the politicians, the news-mongers, and idle in general. It was called *Paul's walk*; and is mentioned in the old plays and other books of the times.

Notwithstanding the magnificence of this noble pile, however, it is remarked to have many defects. Its situation is such, that it cannot be viewed at a distance. The division of the porticos, and the whole structure into two stories on the outside, certainly indicate a like division within, which is acknowledged to be a fault. The dome, it has also been observed, bears too great a proportion to the rest of the pile, and ought to have been raised exactly in the centre of the building; besides that, there ought to have been two steeples at the east end, to correspond with those at the west. On entering this church, we instantly perceive an obvious deficiency, not only of elevation but length, to assist

the perspective; and the columns are heavy and clumsy, rather incumbering the prospect than enriching it.

St Paul's occupies an area of fix acres, and is raised all round with iron balustrades, each about five feet and an half high, fixed on a dwarf wall of hewn stone. In the west end of this area is a marble statue of Queen Anne, holding a sceptre in one hand, and a globe in the other, surrounded with four emblematical figures representing Great Britain, France, Ireland, and America.

Besides very large contributions for carrying on this edifice, the parliament granted a duty on sea-coal, which, at a medium, produced 5000 l. a-year; and the whole expence of the building is said to have amounted to 736,752 l. 2s. 3d.

On the east side of the cathedral is *St Paul's School*, founded in 1509 by Dr John Collet dean of this church, who endowed it for a principal-master, an under-master, a chaplain, and 153 scholars.

In Warwick-lane, in the same ward, stands the *College of Physicians*, erected in 1682 by Sir Christopher Wren. It is built of brick, and has a spacious stone frontispiece. Near the south extremity of the Old Bailey, on the east side, is the hall of the Company of Surgeons, with a theatre for dissection.

Adjoining to Christ-church in Newgate-street is *Christ's-Hospital*, which, before the dissolution of monasteries by Henry VIII. way a house of grey-friars. The hospital was founded by King Edward VI. for supporting and educating the fatherless children of poor freemen of this city; of whom 1000 of both sexes are generally maintained in the house or out at nurse, and are likewise clothed and educated. In 1673, a mathematical school was founded here by Charles II. endowed with L. 320 a-year; and a writing-school was added in 1694 by Sir John Moor, an alderman of the city. After the boys have been seven or eight years on the foundation, some are sent to the university and others to sea; while the rest, at a proper age, are put apprentices to trades at the charge of the hospital. At first their habit was a russet cotton, but was soon after changed for blue, which has ever since continued to be their colour; and on this account the foundation is frequently called the *blue-coat hospital*. The affairs of this charity are managed by a president and about 300 governors, besides the lord-mayor and aldermen. The fabric, which is partly Gothic and partly modern, was much damaged by the fire of 1666, but was soon repaired, and has been since increased with several additions. The principal buildings, which form the four sides of an area, have a piazza round them with Gothic arches, and the walls are supported by abutments. The front is more modern, and has Doric pilasters supported on pedestals.

In Cattle-Baynard ward is a large structure called *Doctors-Commons*. It consists of several handsome paved courts, in which the judges of the court of admiralty, those of the court of delegates, of the court of arches, and the prerogative court, with the doctors that plead causes, and the proctors of the place, all live in a collegiate way; and from commoning together, as in other colleges, the name of Doctors-Commons is derived. Here courts are kept for the trial of civil and ecclesiastical causes under the archbishop of Canterbury

London.

and the bishop of London. The college has an excellent library, every bishop at his consecration giving L. 20 or L. 50 towards purchasing books for it.

82
College of
Heralds.

Near Doctors-Commons, on St Bennet's Hill, is the *College of Heralds*, who were incorporated by King Richard III. Besides the chief officer, who is the earl-marshal of England, here are three kings at arms, *viz.* Garter, Clarenceux, and Norroy, with six heralds, four pursuivants, and eight proctors. Garter attends the infatuements of knights of that order, carries the garter to foreign princes, regulates the ceremonies at coronations, and the funeral of the royal family and nobility: Clarenceux directs the funeral ceremonies of those under the degree of peers south of Trent; and Norroy performs the like office for those north of Trent. This building was originally the house of the earl of Derby. It is a spacious quadrangle, built of brick, and has convenient apartments. Here are kept records of the coats of arms of all the families and names in England, with an account when they were granted, and on what occasion.

83
Bridewell.

In Farringdon-ward Without is a large building called *Bridewell*, from a spring formerly known by the name of St Bridget's or St Bride's-Well. It was originally a royal palace, and occupied all the ground from Fleet-ditch on the east to Water-lane on the west. That part of it now called *Salisbury-court* was given to the bishops of Salisbury for their town-residence; and the east part, which was rebuilt by King Henry VIII. is the present Bridewell. It was granted to the city by Edward VI. as an hospital; and he endowed it for the lodging of poor travellers, and for the correction of vagabonds, strumpets, and idle persons, as well as for finding them work. In one part of the building 20 artificers have houses; and about 150 boys, distinguished by white hats and blue doublets, are put apprentices to gloves, flax dressers, weavers, &c. and when they have served their time are intitled to the freedom of the city, with L. 10 towards carrying on their respective trades. The other part of Bridewell is a receptacle for disorderly persons, who are kept at beating hemp and other hard labour.

Near Bridewell is *St Bride's Church*, a stately fabric 111 feet long, 57 broad, and 41 high, with a beautiful spire 234 feet in altitude, and has a ring of 12 bells in its tower.

84
Blackfriars
Bridge.

Opposite to Fleet-ditch, over this part of the river, stands *Blackfriars Bridge*; a most elegant structure built after the design of Mr Robert Mylne. The situation of the ground on the two shores obliged the architect to employ elliptical arches; which, however, have a very fine effect. The number of arches is nine; of which the centre one is 100 feet wide. The whole length is 995 feet: the breadth of the carriage-way is 28 feet, and that of the two foot-ways 7 each. Over each pier is a recess; an apology for the beautiful Ionic pillars which support them, and which have a most beautiful effect from the river. This bridge was begun in 1760; and finished in 1768, at the expence of L. 152,840, to be discharged by a toll upon the passengers. It is situated almost at an equal distance between those of Westminster and London, commands a view of the Thames from the latter to Whitehall, and discovers the majesty of St Paul's in a very striking manner.

London.

85
Smithfield.

West Smithfield. In this ward is an area containing three acres of ground, called in old records *Smithfield-Pond* or *Horfe-Pool*, it having been formerly a watering place for horses. It was in ancient times the common place of execution; and at the south-west corner there was a gallows called the *Elms*, from a number of elm-trees that grew in the neighbourhood. It was likewise the scene of public jousts and tournaments, and has been a market-place for cattle above 500 years.

On the south-side of this area, and contiguous to Christ's hospital, is *St Bartholomew's Hospital*. It was originally founded soon after the accession of Henry I. by Rahere the king's jester, as an infirmary for the priory of St Bartholomew the Great, which then stood near the spot. But upon the dissolution of religious houses, Henry VIII. refounded it, and endowed it with 500 marks a year, on condition that the citizens should pay the same sum annually for the relief of 100 lame and infirm patients. The endowments of this charity have since been so much enlarged, that it now receives the distressed of all denominations. In 1702, a beautiful frontispiece was erected towards Smithfield, adorned with pilasters, entablature, and a pediment of the Ionic order, with a statue of King Henry VIII. standing in a niche in full proportion, and those of two cripples on the top of the pediment over it. In 1720, a plan was formed for rebuilding the rest of this hospital, in consequence of which a magnificent edifice has been erected.

Among many other privileges granted by Henry I. to the prior and canons of the monastery of St Bartholomew the Great, and to the poor of the infirmary, was that of keeping a fair in Smithfield on the eve, day, and morrow, of St Bartholomew. This fair, called *Bartholomew-fair*, has been held annually ever since; and by the indulgence of the magistrates of London, to whom the privilege of keeping it devolved upon the dissolution of the priory, it used to continue a fortnight. A great number of booths was erected in it by the actors of the theatres, for the exhibition of dramatic performances of various kinds; and it became at length a scene of so much licentiousness and riot, that Sir John Barnard when lord-mayor of London reduced the time of the fair to its original duration of three days. This laudable example has been followed ever since; and the magistrates have likewise prohibited all public exhibitions which had been formerly accompanied with so much disorder.

In a street in this ward, called the *Old Bailey*, is a hall named *Justice-hall*, or the *Sesſon's-house*, where a court is held eight times a year by the king's commission of oyer and terminer for the trial of criminals for offences committed within the city of London and county of Middlesex. The judges of this court are the lord-mayor, those of the aldermen that have served that office, and the recorder, who are attended by the sheriffs and by one or more of the national judges.

In this street is also the great criminal prison, lately built in a much more convenient situation, and on a more enlarged plan than the former prison, called *Newgate*; by which name it is still distinguished. Here the unfortunate debtor will no longer be annoyed by the dreadful rattle of chains, or by the more horrid sounds issuing from the lips of those wretched beings who set defiance to all laws divine and human; and

88
Newgate.

London. and here also the offender, whose crime is not capital, may enjoy all the benefits of a free open air.

89
Fleet-prison.
In this ward is likewise a prison called the *Fleet-prison*, from a small river named the Fleet which formerly run by it: this building is large, and reckoned the best in the city for good rooms and other conveniences. It has the benefit of a large yard, which is enclosed with a very high wall. This prison is as ancient as the reign of Richard I. and belongs to the court of chancery, &c.

90
The Rolls
In Chancery-lane, in this ward, is an office consisting of a house and chapel, called the office and chapel of the *Rolls*, from being the great repository of the modern public rolls and records of the kingdom. This building was originally the house of an eminent Jew; but being forfeited to the crown, King Henry III. in the year 1223 converted it into an hospital for the reception and accommodation of Jewish and other profelytes. In 1377, Edward III. granted this hospital and its chapel to William Bursfall master of the rolls, to whose successors in that office it has ever since belonged. Round this office there is a small district consisting of about 200 houses, called the *Liberty of the Rolls*, over which the magistrates of London have no authority, it being under the government of the master of the rolls.

In this ward are several *Inns* of court and chancery, particularly the Inner and Middle-Temple, Serjeant's-Inn, Clifford's-Inn, Barnard's-Inn, Staples-Inn, and Furnival's-Inn.

91
The Temple.
The Temple received its name from being originally founded by the Knight's-Templars, who settled here in 1185. It was at first called the *New Temple*, to distinguish it from the former house of the Knight's-Templars, which stood in Holborn near Chancery-lane.

The original building was divided into three parts; the Inner, the Middle, and the Outer Temple. The Inner and the Outer Temple were so called, because one was within and the other was without the Bar; and the Middle derived its name from being situated between them. Upon the dissolution of the order of Knights-Templars, the New Temple devolved to the Knights-Hospitalers of St John of Jerusalem, who granted a lease of it to the students of the common law, and converted that part of it called Inner and Middle Temple into two inns of court for the study and practice of the common law. The Outer Temple became a house for the earl of Essex.

The buildings of the Temple escaped the fire in 1666, but were most of them destroyed by subsequent fires, and have since been rebuilt. The two Temples are each divided into several courts, and have pleasant gardens on the banks of the Thames. They are appropriated to distinct societies, and have separate halls, where the members dine in common during term-time. The Inner-Temple hall is said to have been built in the reign of Edward III. and the Middle-Temple hall, which is a magnificent edifice, was rebuilt in 1572 in form of a college-hall. The Middle-Temple gate, Mr Pennant informs us, was erected by Sir Amias Powlet on a singular occasion. It seems that Sir Amias, about the year 1501, thought fit to put Cardinal Wolsey, then parson of Lymington, into the stocks. In 1515, being sent for to London by the cardinal on

account of that ancient grudge, he was commanded not to quit town till farther orders. In consequence, he lodged five or six years in this gateway, which he rebuilt; and to pacify his cminence, adorned the front with the cardinal's cap, badges, cognifiance, and other devices of this butcher's son: so low were the great men obliged to stoop to that meteor of the times! Each temple has a good library, adorned with paintings and well furnished with books. An assembly, called a *parliament*, in which the affairs of the society of the Inner-Temple are managed, is held there every term. Both Temples have one church, first founded in 1185 by the Knights-Templars; but the present edifice is supposed to have been built in 1420. It is supported by neat slender pillars of Suffex marble, and is one of the most beautiful Gothic structures in England. In this church are many monuments, particularly of nine Knights-Templars cut in marble in full proportion, some of them seven feet and a half long; six are cross-legged, and therefore supposed to have been engaged in the crusades. The minister of this church, who is usually called the *master of the Temple*, is appointed by the benchers or senior members of both societies, and presented by a patent from the crown. Shakespeare (whether from tradition or history) makes the Temple garden the place in which the badge of the white and red rose originated; the distinctive badge of the houses of York and Lancaster, under which the respective partizans of each arranged themselves in the fatal quarrel which caused such torrents of English blood to flow.

Near the Temple-bar is the *Devil Tavern*, so called from its sign of St Dunstan seizing the evil spirit by the nose with a pair of hot tongs. Ben Jonson has immortalized it by his *Leges Conviviales*, which he wrote for the regulation of a club of wits held here in a room he dedicated to Apollo; over the chimney-piece of which they are preserved. The tavern was in his days kept by Simon Wadloe; whom, in a copy of verses over the door of the Apollo, he dignified with the title of *King of Skinkners*.

92.
Inns of Chancery.
Serjeant's-Inn is a small inn in Chancery-lane, where the judges and serjeants have chambers, but not houses, as they had in another inn of this name in Fleet-street, which they abandoned in 1730; but in each of them there is a hall and a chapel. *Clifford's-Inn* is an inn of chancery belonging to the Inner-Temple. It was originally a house granted by Edward II. to the family of the Cliffords, from which it derived its name; but was afterwards let upon lease to the students of the law, and in the reign of Edward III. sold to the members of this society. *Bernard's-Inn* is likewise an inn of Chancery belonging to Cray's-Inn. It stands in Holborn, and was the house of John Mackworth dean of Lincoln, who gave it to the professors of the law. *Staple's-Inn* belongs also to Gray's-Inn, and is situated in Holborn. It was once a hall for the merchants of the staple for wool, whence it derives its name; but it was purchased by the benchers of Gray's-Inn, and has been an inn of chancery since the year 1415. *Furnival's-Inn* is an inn of chancery belonging to Lincoln's-Inn, and was once the house of the family of the Furnivals, by whom it was let out to the professors of the law. It is a large old building, with a hall and a pleasant garden.

London.

93
Bethlehem
Hospital.

In Colman-street ward, on the south-side of a large square called *Moorfields*, stands *Bethlehem-hospital*, founded in 1675 by the lord-mayor and citizens of London for the reception and cure of poor lunatics. It is a noble edifice, built with brick and stone, and adorned with pilasters, entablatures, and sculpture; particularly with the figures of two lunatics over the grand gate, which are well executed. This building is 540 feet long and 40 broad, exclusive of two wings of a later erection, intended for the reception of such lunatics as are deemed incurable. This hospital contains a great number of convenient cells or apartments, where the patients are maintained and receive all medical assistance without any other expense to their friends than that of bedding. The structure is divided into two stories, through each of which runs a long gallery from one end of the house to the other. On the fourth side are the cells, and on the north the windows that give light to the galleries, which are divided in the middle by handsome iron-gates, to keep the men and women separate. This hospital being united to that of *Bridewell*, both are managed by the same president, governors, treasurer, clerk, physician, surgeon, and apothecary; but each has a steward and inferior officers peculiar to itself.

94
St Luke's
Hospital.

Opposite to Bethlehem-hospital stood that of *St Luke*, a long plain building, till of late appropriated to the same purposes, but wholly independent of the former. It was founded on the humane consideration that Bethlehem was incapable of receiving all the miserable objects which were offered. Of late years the patients were removed from the old hospital to a new one erected under the same name in Old-street, on the plan of the former, extending in front 393 feet. The old hospital is now pulled down, and replaced by a handsome row of houses. Uncured patients may be taken in again, by a very liberal regulation, on the payment of five shillings a week: so that their friends may, if they choose, try a second time the force of medicine on their unhappy relations or acquaintances.

95
Different
Markets.

Besides the three markets already mentioned at Smithfield for cattle and hay, at *Leadenhall* for butcher's meat, wool, hides, and Colchester baize, and at *Billinggate* for fish; there are in this city the following other markets, which are all very considerable, viz. *Honey-lane*, *Newgate*, and *Fleet-market*, chiefly for flesh, though with separate divisions for fish, butter, eggs, poultry, herbs, and fruit; and the *Three-Cranes* market, for apples and other fruit. The principal corn-market is held in a neat exchange situated in *Mark-lane*, and that for flour at *Queenthite*. In *Thames-street*, near *Billinggate*, there is an exchange for dealers in coals and masters of vessels in that trade to transact their business.

II. *The Borough of SOUTHWARK.* It was called by the Saxons *Suth*, or the "Southwork," in respect to some fort or fortification bearing that aspect from London. It was also called the *Borough*, or *Bury*, probably from the same reason. It was long inde-

pendent of the city of London: but, in consideration of the inconveniences arising from the escape of malefactors from the great capital into this place. it was in 1327 granted by Edward III. to the city on payment of L. 10 annually. It was then called the *village of Southwark*; it was afterwards styled the *bailiwick of Southwark*, and the mayor and commonalty of London appointed the bailiff. This power, however, not being sufficient to remedy the evil, a more intimate connection was thought necessary; and in the reign of Edward VI. on a valuable consideration paid to the crown, it was formed into a 26th ward, by the title of *Bridge-Ward Without*; with a reservation of certain privileges enjoyed there by the archbishop of Canterbury and some other ecclesiastics. In consequence of this, it was subjected to the lord-mayor of London, with the steward and bailiff. But Southwark being divided into two parts, this is to be understood of the division called the *Borough Liberty*, which consists of three of the parishes belonging to the town, with the greater part of a fourth parish. For the city division, the lord-mayor by his steward holds a court of record every Monday at the sessions-house on St Margaret's Hill in this borough for all debts, damages, and trespasses, within the limits of his jurisdiction.—The other division is called the *Clink*, or the *Manor of Southwark*, and is subdivided into the *Great Liberty*, the *Guild-hall*, and the *King's Manor*; for each of which subdivisions a court-leet is held, where the constables, ale-conners, and flesh-tasters, are chosen, and other business of this kind transacted. A court-house, called *Union-Hall*, has lately been built in the new street called *Union-street*, which leads in a direct line from the high-street in the Borough to Great Surry-street Blackfriars-road. The *Clink* liberty is under the jurisdiction of the bishop of Winchester, who, besides a court-leet, keeps here a court of record on the Bank-side near St Saviour's church by his steward or bailiff, for pleas of debt, damages, and trespasses. Courts-leet are also kept at Lambeth, Bermondsey, and Rotherhithe, three small districts adjoining to the Borough.—There is a counter for the imprisonment of offenders in the bailiwick, and another for the *Clink* liberty; to which may be added the *Surry* workhouse for vagrants. Besides these, there is the *Marshalsea-prison*, which is the county-gaol for felons, and the admiralty-gaol for pirates (G); in which is a court first erected for trials of causes between the king's domestics or menial servants, of which the knight-marshal is president, and his steward judge, to whom belong four counsellors and six attorneys; and the court is held every Friday by him or his deputy, for debt, damages, and trespasses, in causes for 10 miles round Whitehall, excepting London.—In this quarter is also the *King's-bench* prison, the rules of which are above two miles in circuit, and comprise the greatest part of St George's Fields. Here was committed Henry prince of Wales, afterwards King Henry V. by the spirited and honest judge Gascoigne, for striking or insulting him on the bench.

97
Courts.

98
Prisons.

(c) In 1377 this prison was broke open by a mob of sailors, who murdered a gentleman confined in it for killing one of their comrades, and who had been pardoned by the court. It was again broke open by Wat Tyler and his followers in 1381. It escaped in the infamous riots of 1780; while the King's-Bench, the Borough-prison, and the Clink-prison, were nearly at the same instant sacrificed to their fury.

London.

bench.

In this prison the allowance is somewhat better than that of the commons prisons; for which reason, many debtors remove themselves hither by *habeas corpus*. It is properly a place of confinement in all cases triable in the King's-bench court.—The first time that Southwark is mentioned in history is on occasion of Earl Goodwin's falling up the river to attack the royal navy of 50 ships lying before the palace of Westminster: this was in 1052, when we are told he went *ad Subworce*, and stayed there till the return of the tide.

99
Parishes,
&c.

Southwark consists of the parishes of St Olave, St Saviour, St George, and St Thomas; the parish of Christ-church, though contiguous to the borough, is in the county of Surry.

The principal church in Southwark is that of *St Saviour*, which was formerly a priory of regular canons. Being dedicated to the Virgin Mary, and situated near the bank of the Thames, it was called *St Mary Over Ree*, or *Overy*, by which appellation it is commonly known. This church is built in the manner of a cathedral, with three aisles from east to west, and a cross aisle. It is reckoned the largest parish-church in England, the three aisles first mentioned measuring 263 feet in length, and the cross aisle 109 feet. The height within is 47 feet, and it has a tower with four spires 150 feet high.

Not far from St George's church stood the magnificent palace of Charles Brandon duke of Suffolk, the deserved favourite of Henry VIII. After his death, in 1545, it came into the king's hands, who established here a royal mint. It at that time was called *Southwark Place*, and in great measure preserved its dignity. Edward VI. once dined in it. His sister and successor presented it to Heath archbishop of York, as an inn or residence for him and his successors whenever they repaired to London. As to the mint, it became a sanctuary for insolvent debtors; at length becoming the pest of the neighbourhood, by giving shelter to villains of every species that awakened the attention of parliament; which, by the statutes 8 and 9 Will. III. 9 George I. and 11 George I. entirely took away its abusive privileges.

100
Ancient
places of dis-
sent.

In the parish of Christ-church, near the water on Bankside, stood *Paris-garden*, one of the ancient play-houses of our metropolis. Ben Jonson is reproached by one Decker, an evasive critic, with his ill success on the stage, and in particular with having performed the part of Zuliman at Paris-garden. It seems to have been much frequented on Sundays. This profanation (Mr Pennant observes) was at length fully punished by the dire accident which befel the spectators in 1582, when the scaffolding suddenly fell, and multitudes of people were killed or miserably maimed. The omen seems to have been accepted; for in the next century the manor of Paris-garden was erected into a parish, and a church founded under the name of Christ's.

Beyond this place of amusement were the Bear-garden and place for baiting of bulls, the *British circi*: "Herein (says Stow) were kept bears, bulls, and other beasts to be bayted; as also mastives in several kennels nourished to bayt them. These bears and other beasts are there kept in plots of ground scaffolded about for the beholders to stand safe." This was then

London.

an amusement for persons of the first rank: our great, if not good, Elizabeth caused the French ambassadors to be carried to this theatre, to divert them with these bloody spectacles.

Not far from these scenes of cruel pastime was the *Bordello* or *Stews*, permitted and openly licensed by government, under certain laws or regulations. They were farmed out. Even a lord-mayor did not disdain to own them; but rented them to the *Froes*, that is "the bawds," of Flanders. Among other singular regulation, no freeholder was to admit married women; nor were they to keep open their houses on Sundays; nor were they to admit any women who had on them the perilous infirmity of burning. These infamous houses were very properly suppressed in the reign of Henry VIII.

The bishop of Winchester had formerly a palace here with a park (the same that is now called *Southwark-park*), which is since converted into warehouses and tenements, held by lease from the bishops of that see.

Besides several alms-houses, there are here *St Thomas's* and *Guy's hospitals*, two of the noblest endowments in England. The former was first erected in 1215 by Peter de Rupibus bishop of Winchester, who endowed it with land to the amount of L.343 a year; from which time it was held of the abbots of Bermondsey, one of whom in 1428 granted a right to the master of the hospital to hold all the lands it was then in possession of belonging to the said abbot and convent, the whole revenue of which did not exceed L.266: 17: 6 *per annum*. In the year 1551, after the citizens of London had purchased of Edward VI. the manor of Southwark and its appurtenances, of which this hospital was a part, they expended L.1100 in repairing and enlarging the edifice, and immediately received into it 260 patients; upon which the king in 1553 incorporated this hospital with those of Christ-church and Bridewell in the city of London. The building being much decayed, three beautiful squares adorned with colonades were erected by voluntary subscription in 1693, to which in 1732 the governors added a magnificent building, consisting of several wards with proper offices. The annual disbursements of this hospital have for many years amounted to L.8000. The house is divided into 19 wards, and is said to contain 474 beds.

Adjoining to St Thomas's stands *Guy's hospital*, perhaps the most extensive charitable foundation that ever was established by one man in private life. The founder of this hospital was Thomas Guy, a bookseller in Lombard-street, London, who lived to see the edifice roofed in; and at his death, in 1724, left L.238,292, 16s. including the expence of the building, to finish and endow it. This hospital consists of two capacious squares, containing 12 wards and 435 beds. It was incorporated by charter from parliament, and the first governors were appointed in 1725.

In St George's Fields, westward of the King's-bench prison, is the *Magdalen hospital* for the reception of penitent prostitutes; a little farther is situated the *Asylum* for orphan girls; and not far distant is the Westminster Lying-in hospital: Institutions, of which the following feeling and animated account is given by Mr Pennant.

111
The Stews.

112
St Thomas's
Hospital.

113
Gray's Hos-
pital.

"The

London.

114
The Asylum.

"The *Asylum* is an institution of a most heavenly nature, calculated to save from perdition of soul and body the brighter part of the creation; such on whom Providence hath bestowed angelic faces and elegant forms, designed as blessings to mankind, but too often debased to the vilest uses. The hazard that these innocents constantly are liable to from a thousand temptations, from poverty, from death of parents, from the diabolical procures, and often from the stupendous wickedness of parents themselves, who have been known to sell their beautiful girls for the purpose of prostitution, induced a worthy band to found in the year 1758 the *Asylum* or House of Refuge. Long may it flourish, and eternal be the reward of those into whose minds so amiable a conception entered!

115
The Magdalen Hospital.

"To afford means of salvation to those unhappy beings who had the ill fortune to lose the benefits of this divine institution, the *Magdalen Hospital* was instituted for the reception of the penitent prostitutes. To save from vice, is one great merit. To reclaim and restore to the dignity of honest rank in life, is certainly not less meritorious. The joy at the return of one sinner to repentance is elicited by the highest authority worthy of the heavenly host. That ecstasy, I trust, this institution has often occasioned. Since its foundation in the same year with the former, to December 25th, 1786, not fewer than 2471 have been admitted. Of these (it is not to be wondered that long and evil habits are often incurable) 300 have been discharged, uneasy under constraint; 45 proved lunatics, and afflicted with incurable fits; 60 have died; 52 never returned from hospitals they were sent to; 338 discharged for faults and irregularities. How to be dreaded is the entrance into the bounds of vice, since the retreat from its paths is so difficult! Finally, 1608 prodigals have been returned to their rejoicing parents; or placed in reputable services, or to honest trades, banes to idleness, and securities against a future relapse."—Into this charity, every woman who has been seduced (and is not pregnant or diseased), whether recommended or not, may apply for admission to the committee, who meet for that purpose on the first Tuesday in every month.

116
Lying-in Hospital.

Akin to those charities is that of the *Lying-in Hospital*: which is not intended merely for the reception of "the honest matron who can deposit her burden with the consciousness of lawful love; but also for the unhappy wretches whom some villain in the unguarded moment has seduced, and then left a prey to desertion of friends, to poverty, want, and guilt. Left such 'may be driven to despair by such complicated misery, and be tempted to destroy themselves and murder their infants,' here was founded in 1765 this humane preventative the Westminster New Lying-in Hospital, in which every assistance and accommodation requisite in such situations are provided in the most attentive and liberal manner. To obviate all objection to its being an encouragement to vice, no one is taken in a second time: but this most excellent charity is open to the worthy distressed matron as often as necessity requires. None are rejected who have friends to

recommend. And of both descriptions upwards of 4000 have experienced its salutary effect."

London.

St George's Fields are now almost covered with new-erected buildings, from the ditch at the end of St George's Great Surry-street, or Burrow's buildings, to the Fishmongers almshouses, in one direction; and from the Marshalsea-prison to the Dog and Duck, in the other direction; with several irregular indentations in its circumference: And where the principal roads meet an obelisk has been erected, pointing out the distance it stands from different parts of London, Westminster, and Blackfriars bridges. Among the buildings which serve to embellish and improve this entrance to London, Chatham square and Bridgestreet Blackfriars may be particularly specified.

118
Lambeth Palace.

At *Lambeth*, the archbishops of Canterbury have had a palace. According to Mr Pennant, it was in the earlier times a manor, possibly a royal one; for the great Hardknut died here in 1042, in the midst of the jollity of a wedding dinner; and here, without any formality, the usurper Harold is said to have snatched the crown and placed it on his own head. At that period it was part of the estate of Goda, wife to Walter Earl of Mantes, and Eustace Earl of Boulogne; who presented it to the church of Rochester, but reserved to herself the patronage of the church. It became in 1197 the property of the see of Canterbury, by exchange transacted between Glanville Bishop of Rochester, and the Archbishop Hubert Walter. The building was improved by Langton the successor of Walter; but it was afterwards neglected and became ruinous. "No pious zeal (says Mr Pennant) restored the place, but the madnels of priestly pride. Boniface, a wrathful and turbulent primate, elected in 1244, took it into his head to become a visitor of the priory of St Bartholomew, to which he, had no right. The monks met him with reverential respect, but assured him the office did not belong to the bishop. The meek prelate rushed on the subprior, knocked him down, kicked, beat, and buffeted him, tore the cope off his back, and stamped on it like one possessed, while his attendants paid the same compliments to all the poor monks. The people enraged at his unpriestly conduct would have torn him to pieces; when he retired to Lambeth, and, by way of expiation, rebuilt it with great magnificence.—At a subsequent period it was very highly improved by the munificent Henry Chicheley, who enjoyed the primacy from 1414 to 1443. I lament to find so worthy a man to have been the founder of a building so reproachful to his memory as the Lollards tower, at the expence of near L. 280. Neither Protestants or Catholics should omit visiting this tower, the cruel prison of the unhappy followers of Wickliffe. The vaulted staples and rings to which they were chained before they were brought to the stake, ought to make Protestants bless the hour which freed them from so bloody a religion." During the civil wars of the last century, this palace suffered greatly; but at the restoration, the whole was repaired by Archbishop Juxton.

The parish church of Lambeth (H), which is at a small distance

(H) In describing this church, Mr Pennant takes occasion to mention the sad example of fallen majesty in the person of Mary d'Este, the unhappy queen of James II.; who flying with her infant prince from the ruin

London.

distance from the palace, has a plain tower; and the architecture is of the gothic of the time of Edward IV. It has very little remarkable in it, except the figure of a pedlar and his dog, painted in one of the windows; and tradition says, that the parish was obliged to this man for the bequest of a piece of land, which bears the name of *the Pedlar's Acre*. In the churchyard is the tomb of old Tradescant. Both father and son were great travellers; and the former is supposed to have visited Russia and most parts of Enrope, Turkey, Greece, many of the eastern countries, Egypt, and Barbary; out of which he introduced multitudes of plants and flowers, unknown before in our gardens. The monument is an altar tomb; embellished with emblematical sculptures; and bearing the following inscription, which is both singular and historical:

Know, stranger, ere thou pass, beneath this stone
Lye John Tradescant, grandfire, father, son;
The last dy'd in his fang; the other two
Liv'd till they had travell'd Art and Nature through,
As by their choice collection may appear,
Of what is rare, in kind, in sea, in air;
Whilst they (as Homer's Iliad in a nut)
A world of wonders in one closet flut:
These famous Antiquarians, that had been
Both gardeners to the Rose and Lily Queen,
Transplanted now themselves, sleep here; and when
Angels shall with their trumpets wake men,
And fire shall purge the world, these hence shall rise,
And change this garden for a paradise.

120
Lambeth-
marsh.

From Lambeth, eastward along the river side, was once a long tract of dreary marsh, and still in parts called *Lambeth-marsh*; about the year 1660, there was not a house on it from Lambeth palace as far as Southwark. In a street called *Narrow-wall* (from one of the ancient embankments) is Mrs Conde's noted

manufactory of artificial stone (1): And at a small distance, Mess. Beaufoy's great work for making wines (κ), and that for making vinegar (λ).

This ground, so profitable to the proprietors, and so productive of revenue to the state, was within memory the scene of low dissipation. Here stood Cuper's garden, noted for its fire-works, and the great resort of the profligate of both sexes. This place was ornamented with several of the mutilated statues belonging to Thomas Earl of Arundel, which had been for that purpose begged from his lordship by one Boyder Cuper, a gardener in the family. The great timber-yards beneath which these antiquities were found, are very well worthy of a visit. One would fear that the forests of Norway and the Baltic would be exhausted, to supply the want of our overgrown capital, were we not assured that the resources will successively be increasing equal to the demand of succeeding ages.— In this parish are also the vast distilleries, till of late the property of Sir Joseph Mawbey; where are seldom less than 2000 hogs constantly grunting, and kept entirely on the grains.

III. *City and Liberties of WESTMINSTER.* The city of Westminster derives its name from a *minster*, or abbey, and *west*, on account of its situation with respect to St Paul's cathedral, which was formerly called *Eastminster*. In ancient times this district stood upwards of a mile from the city of London, and contained only two parishes, which were those of St Margaret and St John, with two chapels of ease, but at present it has seven other parochial churches, viz. St Clement's Danes, St Paul's Covent-garden, St Mary's-le-Strand, St Martin's in the Fields, St Anne's, St James's, and St George's Hanover-square.

Westminster

ruin impending over their house, after crossing the Thames from the abdicated Whitehall, took shelter beneath the ancient walls of this church a whole hour, from the rain of the inclement night of December 6th, 1688. Here he waited with aggravated misery, till a common coach, procured from the next inn, arrived, and conveyed her to Gravesend, from whence she failed, and bid an eternal adieu to these kingdoms.

(1) Her repository consists of several very large rooms filled with every ornament which can be used in architecture. The statue, the vase, the urn, the rich chimney-pieces, and, in a few words, every thing which could be produced out of natural stone or marble by the most elegant chisel, is here to be obtained at an easy rate.

(κ) "Where (says Mr Pennant) the foreign wines are most admirably mimicked. Such is the prodigality and luxury of the age, that the demand for many sorts exceeds in a great degree the produce of the native vineyards. We have skillful fabricators, who kindly supply our wants. It has been estimated, that half of the port, and five-sixths of the white wines consumed in our capital, have been the produce of our home wine presses. The product of duty to the state from a single house was in one year, from July 5th 1785, to July 5th 1786, not less than L. 7,363: 9: 8½. The genial banks of the Thames opposite to our capital, yield almost every species of white wine; and by a wondrous magic, Mess. Beaufoy pour forth the materials for the rich Frontiniae, to the more elegant tables; the Maderia, the Calcavella, and the Lisbon, into every part of the kingdom."

(λ) "There is a magnificence of business (our author remarks) in this ocean of sweets and fours, that cannot fail exciting the greatest admiration: whether we consider the number of vessels or their size. The boasted tun at Heydelberg does not surpass them. On first entering the yard, two rise before you, covered at the top with a thatched dome; between them is a circular turret, including a winding staircase, which brings you to their summits, which are above 24 feet in diameter. One of these conservatories is full of sweet wine, and contains 58,109 gallons, or 1,815 barrels of Winchester measure. Its superb associate is full of vinegar, to the amount of 56,799 gallons, or 1,774 barrels of the same standard as the former. The famous German vessel yields even to the last by the quantity of 40 barrels.—Besides these, is an avenue of lesser vessels, which hold from 32,500 to 16,974 gallons each. After quitting this Brobdingnagian scene, we pass to the acres covered with common barrels: we cannot diminish our ideas so suddenly, but at first we imagined we could quaff them off as easily as Gulliver did the little hogheads of the kingdom of Lilliput."

London.

121
Great ma-
nufactory.122
City and
liberties of
Westmin-
ster.

London.

133
Govern-
ment of
Westmin-
ster.

Westminster was anciently called Thorny-island, from its having been covered with thorn-bushes, and encompassed by a branch of the Thames, which is said to have run through the ground now called St James's-park, from west to east, and to have rejoined the river at Whitehall.

Till the general dissolution of religious houses, Westminster was subject to the arbitrary rule of its abbot and monks; but in 1541, upon the surrender of William Benson the last abbot, Henry VIII. not only turned it into an honour, but created it the see of a bishop, and appointed for a diocese the whole county of Middlesex, except Fulham, which belonged to the bishop of London. This bishoprick, however, soon after its institution, was dissolved by Edward VI.

The city of Westminster is governed by a high steward, an officer of great dignity, who is usually one of the first peers in the realm; and is chosen for life by the dean and chapter of the collegiate church of St Peter. There is also a deputy steward and a high bailiff, who also hold their offices for life; being nominated by the dean and chapter, and confirmed by the high steward.

The dean and chapter are invested with an ecclesiastical and civil jurisdiction within the liberties of Westminster, St Martin's-le-Grand, near Cheapside, in the city of London, and some towns in Essex, which are exempted from the jurisdiction of the bishop of London and the archbishop of Canterbury.

124
Churches.

St Margaret's church was founded by Edward the Confessor, since which time it has been frequently rebuilt. In the east end of this church is a window curiously painted, with the history of the crucifixion; and with the figures of several apostles and saints finely executed. It formerly belonged to a private chapel at Copt-hall, near Epping in Essex, and was purchased by the officers of this parish some years ago for 400 guineas. In this church the house of commons attends divine service on state holidays.

The church of *St John the Evangelist* was erected in 1778, and having sunk considerably whilst it was building, occasioned an alteration of the plan. On the north and south sides are magnificent porticoes, supported by vast stone pillars, as is also the roof of the church; at each of the four corners is a beautiful stone tower and pinnacle, which were added with the view of making the whole structure sink equally. The parts of this building are held together by iron bars, which run across even the aisles.

125
Westmin-
ster-abbey,
and its
chapels.

The most remarkable structure in Westminster is the *abbey-church of St Peter*. On its site stood once a temple of Apollo, which according to tradition was thrown down by an earthquake in the time of Antoninus Pius; and from the ruins of which, Sebert king of the West Saxons raised a Christian church, which was ruined by the Danes. It was repaired by Edward the Confessor, and given to a few monks; and this spot he chose for his burial-place. Henry III. 160 years after, took down this fabric of Edward's, and erected a new church, which was 50 years in building. It suffered much by fire in 1274, but was repaired by Edward I. Edward II. and the abbots. In 1700 this church being much decayed, the parliament granted money for repairing it, and has fre-

N° 187.

London.

quently repeated the bounty since that time. The form of the abbey is that of a long cross: its greatest length is 489 feet, and the breadth of the west front 66 feet; the length of the cross aisle is 189 feet, and the height of the roof 92 feet. At the west end are two towers: the nave and cross aisle are supported by 50 slender pillars of Sussex marble, exclusive of pillars. In the upper and lower ranges there are 94 windows, all which, with the arches, roofs, and doors, are in the Gothic taste. The inside of this church is much better executed than the outside: and the perspective is good, particularly that of the grand aisle. The choir, from which there is an ascent by several steps to a fine altar-piece, is paved with black and white marble; having 28 stalls on the north, the same number on the south, and eight at the west end. The altar is made of a beautiful piece of marble, the gift of Queen Anne, inclosed by a curious balustrade, and upon a pavement of porphyry, jasper, Lydian, and serpentine stones, laid in the Mosaic style, at the expense of abbot Ware, A. D. 1272; and is said to be one of the most beautiful of its kind in the world. On each side of this altar a door opens into St Edward's chapel; round which are 10 other chapels, ranging from the north to the south cross aisles, and are dedicated, 1. To St Andrew. 2. To St Michael. 3. To St John Evangelist. 4. Islop's chapel. 5. To St John Baptist. 6. To St Paul. 7. Henry V.'s chapel. 8. To St Nicholas. 9. To St Edmund. 10. To St Benedict.

In St Edward's chapel are still to be seen the remains of his shrine; which, though now in obscurity, and robbed of all its riches and lustre, was once esteemed the glory of England, so far as art and riches could make it. Here are the tombs of King Edward I. and several other kings and queens of England; and here also is shown the famous chair in which the kings of Scotland used to be crowned at Scoon. Henry V.'s chapel is divided from St Edward's by an iron screen, on each side of which are statues as big as life.—St Andrew's chapel, which is next the north cross, and the others which surround the choir, are crowded with the monuments of noble personages, worthy the attention of the curious.—At the corner of St Benedict's chapel, an iron gate opens into the south cross aisle; which from the number of monuments erected therein to celebrated English poets, has obtained the name of the *Poets corner*: though here we find a most magnificent monument erected at the fourth end in memory of the late John duke of Argyle and Greenwich; another to William Camden the antiquarian; and others to the celebrated divine Mr Isaac Barrow, to Thomas Parr who died at the age of 152 years, &c.—The south aisle is adorned with 19 curious monuments of the pious, the brave, and the learned; and turning northward from the west door, we view a great number more.

On the east of the abbey, and which, though separate from the other chapels in the choir, seems to Henry's chapel. 126
be one and the same building with the abbey, stands the chapel of King Henry VII. which that king founded in the year 1502, and was at that time styled the wonder of the world, and is now one of the most expensive remains of the ancient English taste and magnificence. There is no looking upon it without admiration.

^{London.} **miration**: it conveys an idea of the fine taste of Gothic architecture in that age: and the inside is so noble, majestic, and of such curious workmanship, that it would take a volume to describe each part with justice and propriety.

Its original intention was to be a dormitory for the royal blood: and so far the will of the founder has been observed, that none have been interred therein but such as have traced their descent from ancient kings. The tomb of King Henry VII. is most magnificent, inclosed with a screen of cast bras, most admirably designed, and as well executed. Within the rails are the figures of that king and his royal consort, in their robes of state, on a tomb of black marble: and at the head of this tomb lie the remains of Edward VI. In different parts of this chapel are the monuments of Lewis Stuart duke of Richmond, George Villars duke of Buckingham, John Sheffield duke of Buckingham, Charles Montague marquis of Halifax, Edward V. and his brother Richard; the vault of James I. and his queen Anne and daughter Mary, on which is a small tomb adorned with the figure of a child; a lofty monument of Queen Elizabeth, and another of Mary Queen of Scots; the monuments for Margaret Douglas daughter of Margaret queen of Scots, Margaret countess of Richmond mother to Henry VII. the vault of King Charles II. and William III. Queen Mary his consort, Queen Anne, and Prince George. Over these royal personages are their effigies (except that of prince George) in waincoat presses, made of wax to resemble life, and dressed in their coronation robes. And at the corner of the great east window, in another waincoat press, stands the effigy of Mary duchess of Richmond daughter to James duke of Richmond and Lenox, dressed in the very robes she wore at the coronation of Queen Anne. On leaving the aisle, you are shown another press, containing the effigy of general Monk, who, on account of his loyalty, and the part he took in the restoration of King Charles II. had a vault appropriated to him and his family amongst the royal blood.

In a fine vault under Henry the VII.'s chapel, is the burying-place of the present royal family, erected by his late majesty king George II. Adjoining to the abbey are the cloysters, built in a quadrangular form, with piazzas towards the court, where several of the prebendaries have their houses.

Near the abbey church is the King's school, usually called *Westminster School*. It was originally founded in 1070, and a second time by Queen Elizabeth in 1560, whence it is sometimes called the *Queen's College*; and is at present one of the greatest schools in the kingdom. The learned antiquary Mr Camden was once master of it, and Ben Jonson one of his scholars. Dr Busby, who was master upwards of 50 years, greatly contributed to keep up its reputation, formed its museum, and improved both the master's and his prebendal house.—This school, instead of one master and one usher as at first, has now an upper and under master, and five ushers, who have about 400 youths under their tuition. A plan was set on foot when the present archbishop of York was master, for building a college for the use of the students, but this did not succeed.

Vol. X. Part I.

On the north-east side of the abbey is an old Gothic building called *Westminster-hall*, first built by William Rufus as an addition to a royal palace, and afterwards rebuilt by Richard II. in the year 1397. It is reckoned one of the largest rooms in Europe, being 200 feet long, 70 broad, and 90 high, supported only by buttresses. The roof is of timber, and was some years ago slated, the old covering of lead being reckoned too heavy. It is paved with stone. In this spacious room the kings of England have generally held their coronation and other solemn feasts; and it is used for the trial of peers. Since the reign of Henry III. the three great courts of Chancery, King's Bench, and Common Pleas, have been held in separate apartments of this hall; and the court of Exchequer above stairs.

Adjoining to the south-east angle of Westminster-hall is a building formerly called *St Stephen's Chapel*, from its having been dedicated to that saint. It was founded by King Stephen; and in 1347 was rebuilt by King Edward III. who converted it to a collegiate church; but since it was surrendered to Edward VI. it has been used for the assembly of the representatives of the commons of England, and is now generally called the *House of Commons*. The benches, which ascend behind one another as in a theatre, are covered with green cloth; the floor is matted; and round the room are waincoat galleries, supported by cantilevers adorned with carved work, in which strangers are often permitted to sit and hear the debates.

On the south side of the hall is the *House of Lords*, so called from being the place where the peers of Great Britain assemble in parliament. It is an oblong room, not quite so large as the house of commons; and is hung with fine old tapestry, representing the defeat of the Spanish Armada in 1588. The design was drawn by Cornelius Vroom, and the tapestry executed by Francis Spiering. It was not put up till the year 1650, two years after the extinction of monarchy, when the house of lords was used as a committee-room for the house of commons. The heads of the naval heroes who commanded on the glorious day form a matchless border round the work, animating posterity to emulate their illustrious example. Here is a throne for the king, with seats on the right and left for such peers of the realm as are of the blood royal. Before the throne are three broad seats; on the first of which, next the throne, sits the Lord Chancellor, or keeper of the great seal, who is speaker of the house of peers; and on the other two sit the judges, the master of the rolls, or the masters in chancery, who attend occasionally to give their opinions on points of law. The two archbishops sit at some distance from the throne on the right hand, and the other bishops in a row under them. All the benches are covered with red cloth stuffed with wool. Here likewise, by a late order of the house, a gallery for strangers has been erected.

Adjoining to the house of lords is the *Prince's Chamber*, where the king is robed when he comes to the parliament. On the other side is the *Painted Chamber*, which is said to have been Edward the Confessor's bed-chamber, and the room in which the parliaments were anciently opened. Here conferences

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^{London.}

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^{Westminster-hall.}

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^{House of Commons.}

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^{House of Lords.}

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^{Prince's Chamber, &c.}

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^{Painted Chamber.}

¹³³

^{Conferences.}

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^{Westminster School.}

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London. are often held between the two houses, or their committees. Contiguous to those is an apartment called the *Court of Requests*, where such as have business in either house may attend.

¹³² Westminster bridge. Near these buildings is a bridge over the Thames, called *Westminster-bridge*, accounted one of the most complete and elegant structures of the kind in the known world. It is built entirely of stone, and extends over the river at a place where it is 1223 feet broad; which is above 300 feet broader than at London bridge. On each side is a fine ballustrade of stone, with places of shelter from the rain. The width of the bridge is 44 feet, having on each side a fine foot-way for passengers. It consists of 14 piers, and 13 large and two small arches, all semicircular, that in the centre being 76 feet wide, and the rest decreasing four feet each from the other, so that the two least arches of the 13 great ones are each 52 feet. It is computed that the value of 40,000l. in stone and other materials is always under water. This magnificent structure was begun in 1739, and finished in 1750, at the expence of 389,000l. defrayed by the parliament. It was built after the design of Monsi. Labeledy, an ingenious architect, a native of France.

¹³³ Whitehall. On the bank of the Thames, at the east confines of St Margaret's parish, was a palace called *Whitehall*, originally built by Hubert de Burgh earl of Kent, before the middle of the 13th century. It afterwards devolved to the archbishop of York, whence it received the name of *York Place*, and continued to be the city residence of the archbishops till it was purchased by Henry VIII. of cardinal Wolsey in 1530. At this period it became the residence of the court; but in 1697 was destroyed by accidental fire, all except the banquetting-house, which had been added to the palace of Whitehall by James I. according to a design of Inigo Jones. This is an elegant and magnificent structure of hewn stone, adorned with an upper and lower range of pillars, of the Ionic and Composite orders; the capitals are enriched with fruit and foliage, and between the columns of the windows. The roof is covered with lead, and surrounded with a balustrade. The building chiefly consists of one room of an oblong form, 40 feet high, and a proportionable length and breadth. The ceiling is painted by the celebrated Sir Peter Paul Rubens. It is now used only as a chapel-royal, and the other part of the house is occupied with state-offices.

¹³⁴ Horse-guards. Opposite to the banquetting-house stands the *Horse-guards*, so called from being the station where that part of His majesty's troops usually do duty. It is a strong building, of hewn stone, consisting of a centre and two wings. In the former is an arched passage into St James's Park; and over it, in the middle, rises a cupola. In a part of the building is the War-office. Near the Horse-guards is the *Treasury*; a large building, which fronts the Parade in St James's Park; and where the board of treasury is kept.

¹³⁵ Admiralty-office. Eastward of the Horse-guards is the *Admiralty-Office*, a large pile, built with brick and stone. The front towards Whitehall has two deep wings, and a lofty portico supported by four large stone pillars. A piazza, consisting of beautiful columns, runs almost

from one end to the other. The wall before the court has been lately built in an elegant manner, and each side of the gate is ornamented with naval emblems. Besides a hall, and other public apartments, here are spacious houses for seven commissioners of the admiralty.

At a little distance from the admiralty, where three capital streets terminate, is a large opening called *Charing-cross*, from one of the crosses which King Edward I. caused to be erected in memory of his queen Eleanor, and *Charing* the name of a village in which it was built. The cross remained till the civil wars in the reign of Charles I. when it was destroyed by the fanatics, as a monument of popish superstition; but after the Restoration, an equestrian statue of Charles I. was set up in its stead. This, which is of brass, and finely executed, continues to be an ornament to the place. It was made in 1633, at the expence of the Howard-Arundel family. The parliament sold it to a brazier in Holborn, with strict orders to break it to pieces; but he concealed it under ground till the Restoration, when it was set up in 1678.

¹³⁷ Palace. At the west end of the Mall, in St James's Park, Queen's Palace. It was originally known by the name of *Arlington-house*; but being purchased by the late duke of Buckingham's father, who rebuilt it from the ground in 1703, it was called *Buckingham-house*, till the year 1762, when it was purchased by his majesty for a royal residence. It is built of brick and stone, having in the front two ranges of pilasters of the Corinthian and Tuscan orders. It has a spacious court-yard, inclosed with iron rails, fronting St James's Park, with offices on each side, with two pavilions, separated from the mansion-house by colonades of the Tuscan, Doric, and Ionic orders. His majesty has here built a fine library, in an octagonal form, besides several other additions.

¹³⁸ Eastward of the queen's palace stands *St James's Palace*, an old building, which, till the former was purchased by the crown, had been the town-residence of the royal family since the burning of Whitehall in 1697. This palace was built by Henry VIII. and obtained its name from an hospital which formerly stood on the spot. It is an irregular building, of a mean appearance without, but contains several magnificent apartments. Here the court and levees are still kept, and most of the persons belonging to the household have their residence. The chapel of the hospital was converted to the use of the royal family, as it now remains, and is a royal peculiar, exempted from all episcopal jurisdiction. When this palace was built, it abutted in the south-west upon an uncultivated swampy tract of ground, which the king inclosed and converted into a park, called from the palace *St James's Park*. He also laid it out into walks, and collected the water into one body. It was afterwards much enlarged and improved by King Charles II. who planted it with lime trees, and formed a beautiful villa, near half a mile in length, called the *Mall*, from its being adapted to a play at bowls distinguished by that name. He also formed the water into a canal 100 feet broad and 2800 feet long; and furnished the park with a decoy, and other pond for water-fowl; but those have lately been

London. been destroyed, on account of the unwholesome vapours which they excited.

In a line with St James's palace, on the east side, is *Marlborough House*, which belongs to the duke of Marlborough, and is a large brick edifice, ornamented with stone.

¹⁴²
The Strand when first formed. Eastward from Charing-crofs, runs that fine street the *Strand*, which terminates at Temple-bar. In the year 1353 the whole of it was an open highway, with gardens to the water-side. In that year it was so ruinous, that Edward III. by an ordinance directed a tax to be raised upon wool, leather, wine, and goods carried to the staple at Westminster, from Temple-bar to Westminster abbey, for the repair of the road; and that all owners of houses adjacent to the highway should repair as much as lay before their doors. Before the above period, it entirely cut off Westminster from London; nothing intervened except the scattered houses, and a village which afterwards gave name to the whole; and St Martin's stood literally in the fields. But about the year 1560 a street was formed, loosely built; for all the houses on the south side had great gardens to the river, were called by their owners names, and in after-times gave name to the several streets that succeeded them, pointing down to the Thames; each of them had stairs for the convenience of taking boat, of which many to this day bear the names of the houses. As the court was for centuries either at the palace of Westminster or Whitehall, a boat was the customary conveyance of the great to the presence of their sovereign. The north side was a mere line of houses from Charing-crofs to Temple-bar; all beyond was country. The gardens which occupied part of the site of Convent-garden were bounded by fields, and St Giles's was a distant country village. Our capital found itself so secure in the vigorous government of queen Elizabeth, that, by the year 1600, most considerable additions were made to the north of the long line of street just described. St Martin's-lane was built on both sides. St Giles's church was still insulated: but Broad-street and Holborn were completely formed into streets with houses all the way to Snow-hill. Convent-garden and Lincoln's inn fields were built, but in an irregular manner. Drury-lane, Clare-street, and Long-acre, arose in the same period.

¹⁴¹
Northumberland House.

Almost contiguous to Charing-crofs, and upon the south side of the Strand, is that noble palace called *Northumberland-house*, which stands on the site of the hospital of St Mary Rouncival. Henry VIII. granted it to Sir Thomas Caverden. It was afterwards transferred to Henry Howard earl of Northampton; who, in the time of James I. built here a house, and called it after his own name. He left it to his kinsman the earl of Suffolk, lord treasurer; and by the marriage of Algernoon Percy earl of Northumberland, with Elisabeth daughter of Theophilus earl of Suffolk, it passed into the house of the present noble owner. The greater part of the house was built by Bernard Janfen, an architect in the reign of James I. The front next the street was begun by Algernoon in 1748, and finished by the present duke, who married his daughter. Two additional wings to the front next the Thames, and a variety of other improvements both

in building and furniture, have contributed to render this house the largest and most magnificent in London. It contains a gallery of 106 feet long by 26 wide most superbly furnished.

¹⁴²
Durham Yard.

A short way eastward, on the same side, stood *Dur-Durham-bam Tard*, which took its name from a place built originally by the illustrious Thomas de Hatfield, elected bishop of Durham in 1345; designed by him for the town residence of him and his successors. At this place, in 1540, was held a most magnificent feast, given by the challengers of England, who had caused to be proclaimed, in France, Flanders, Scotland, and Spain, a great and triumphant jousting to be holden at Westminster, for all comers that would undertake them. But both the challengers and defendants were English. After the gallant sports of each day, the challengers rode unto this Durham-house, where they kept open household, and feasted the king and queen (Anne of Cleves) with her ladies, and all the court. In the reign of Edward VI. the mint was established in this house, under the management of Sir William Shar- rington, and the influence of the aspiring Thomas Seymour, lord admiral. Durham-house was reckoned one of the royal palaces belonging to queen Elizabeth; who gave the use of it to the great Sir Walter Raleigh.

¹⁴³
The Adel- mas of building, called the *Adelphi*, in honour of phi- two brothers, the ingenious Adams, its architects. Besides its fine lodgings, it is celebrated for its enchanting prospect, the utility of its wharfs, and its subterraneous apartments answering a variety of purposes of general benefit.

¹⁴⁴
The Savoy. Farther on stand the ruins of the *Savoy*. Henry The Savoy, III. had granted to Peter of Savoy, uncle to his queen Eleanor, daughter of Berrenger of Provence, all the houses upon the Thames where this building now stands, to hold to him and his heirs, yielding yearly at the Exchequer three barbed arrows for all services. This prince founded the Savoy, and bestowed it on the foreign hospital of Montjoy. Queen Eleanor purchased it, and bestowed it on her son Edmund earl of Lancaster. It was rebuilt in a most magnificent manner by his son Henry. It was made the place of confinement of John king of France in 1356, after he was taken prisoner at the battle of Poitiers. In 1381 it was entirely destroyed by Wat Tyler, out of spleen to the great owner John of Gaunt. Henry VII. began to rebuild it, with a design of forming it into an hospital for a hundred distressed people, and Henry VIII. completed the design. The revenue at the suppression by Edward VI. amounted to above 500 l. a year. Queen Mary restored it; and her maids of honour, with exemplary piety, furnished it with all necessaries. It was again suppressed by Queen Elisabeth; and at present part serves as lodgings for private people, for barracks, and a scandalous infectious prison for the soldiery and for transport-convicts.

¹⁴⁵
Somerset-house. A little to the eastward stood *Somerset-house*, a palace built by Somerset the Protector in the time of Edward VI.; and to make way for which he demolished a great number of buildings without making any recompence to the owners. Part of the church of St John of Jerusalem and the Tower were blown up for

London.

the sake of the materials; and the cloisters on the north side of St Paul's, with the charnel-house and chapel, underwent the same fate; the tombs being destroyed, and the bones thrown into Finsbury-fields. This happened in 1549; but it is probable that he did not live to inhabit the palace he built, as he was executed in the year 1552. After his death the palace fell to the crown; and it became an occasional place of residence, first to Queen Elizabeth, and afterwards to Catherine queen to king Charles II. It was built in a style of architecture compounded of the Grecian and Gothic; and the back, front, and water-gate, were done from a design of Inigo Jones, about the year 1623. A chapel was begun the same year by that architect, and finished some time after. The whole of this structure was demolished in 1775, in consequence of an act of parliament; and a most magnificent edifice, from a design by Sir William Chambers, has been erected for the accommodation of all the public offices,—those of the Treasury, the Secretary of State, the Admiralty, the War, and the Excise, excepted. The Royal Society, and the Society of Antiquarians, hold their meetings here, in apartments which have been allotted to them by royal munificence; and here also are annually exhibited the works of the British painters and sculptors. The terrace on the south side is a walk bounded by the Thames, and unparalleled for grandeur and beauty of view.

146
St Martin's
and other
churches.

The church of St Martin is distinguished by the name of *St Martin's in the Fields*, from its situation, which was formerly a field, with only a few scattered houses. The church being decayed, was rebuilt by Henry VIII. and again by James I. but not being large enough to accommodate the inhabitants of the parish, it was augmented in 1637, at the charge of Prince Henry, eldest son of James I. and several of the nobility. After many expensive reparations, however, it was entirely taken down in 1720, and a new church began, which was finished in 1726. This is an elegant edifice, built of stone. On the west front is a noble portico of Corinthian columns, supporting a pediment, in which are represented the royal arms in bas relief. The ascent to the portico is by a flight of very long steps. The length of this church is about 140 feet, the breadth 60, and height 45. It has a fine arched roof sustained by stone columns of the Corinthian order. The steeple has a beautiful spire, and one of the best rings of bells in London.

St James's Church was built in the reign of Charles II. at the expence of Henry earl of St Alban's, and other neighbouring inhabitants. The building is of brick and stone, about 85 feet long, 60 broad, and 45 feet high, with a handsome steeple 150 feet in height.

St George's Church, near Hanover-square, is a beautiful structure. This was one of the fifty new churches erected within the bills of mortality, by act of parliament, in the reign of Queen Anne. The ground for the edifice was given by the late lieutenant-general Stewart, who also left 4000 l. to the parish, towards erecting and endowing a charity school; which, by additional benefactions and subscriptions, is become very considerable.

The greater part of the parish of *St Paul's Covent-*

garden, was anciently a garden, belonging to the abbey and convent of Westminster, and was then called *Convent-garden*, a name corrupted into Covent, and more generally Common-garden. In 1552, Edward VI. gave it to the earl of Bedford, with an adjoining field, formerly called the *Seven Acres*, but now, being turned into a long street, called *Long-acre*. The church of St Paul's, Covent-garden, was built by Inigo Jones, and is esteemed one of the most simple and perfect pieces of architecture in England. In the front is a plain portico of the Tuscan order, with massy columns. Before the church is a square area, containing about three acres of ground, called *Covent-garden market*, and is the best in England for herbs, fruit, and flowers. On the north, and part of the east side, is a magnificent piazza, designed by Inigo Jones.

Next to the parish of St Paul, Covent-garden, is that of *St Mary le Strand*. This is also one of the fifty new churches built in the reign of Queen Anne, and is a handsome piece of architecture, though not very extensive. At the entrance, on the west side, is an ascent by a flight of steps, in a circular form, which leads to a similarly shaped portico of Ionic columns, covered with a dome, that is crowned with a vase. The columns are continued along the body of the church, with pilasters of the same order at the corners; and in the intercolumniations are niches handsomely ornamented. Over the dome is a pediment supported by Corinthian columns, which are also continued round the body of the structure, over those of the Ionic order. A handsome balustrade is carried round the top of the church, and adorned with vases.

A little eastward from the preceding church is that of *St Clement's Danes*, situated likewise in the Strand. A church is said to have stood in this place since about the year 700; but the present structure was begun in 1680, designed by Sir Christopher Wren. It is built of stone, with two rows of windows, the lower plain, but the upper ornamented; and the termination is by an attic, the pilasters of which are covered with vases. On the fourth side is a portico, covered with a dome, supported by Ionic columns; and opposite to this is another. The steeple is beautiful, and of a great height.

The church of *St George, Bloomsbury*, is also one of the fifty new churches erected by act of parliament. It is distinguished from all the rest by standing south and north, and by the statue of King George I. at the top of its pyramidal steeple.

In Lamb's Conduit-fields, on the north side of the town, is a large and commodious structure called the *Foundling-hospital*, for the reception of exposed and deserted children. This laudable charity was projected by several eminent merchants in the reign of queen Anne; but was not carried into execution till many years afterwards, when a charter for its establishment was obtained, through the indefatigable assiduity of Mr Thomas Coram, the commander of a merchant vessel, who spent the remainder of his life in promoting this design. From the time of its institution, the parliament has occasionally granted considerable sums for its support; and in some years upwards of 6000 infants have been received.

Not far from hence is an *Hospital for the Small-pox*; and

London.

147
Covent
Garden.

148

St Mary
le Strand,
&c.

149

Foundling,
and other
Hospitals.

London.

and in different parts of the town there are others, either for the sick of all kinds, or those in particular circumstances. Of the latter are several *Lying-in hospitals*, and the *Lock-hospital* for female patients in the venereal disease. Of the former are *St George's* and the *Middlesex hospitals*, besides several infirmaries.

150
Gray's Inn.

Gray's Inn is one of the four principal inns of court; which, though situated within the limits of the parish of St Andrew, Holborn, is yet without the liberties of the city of London. It took its name from an ancient family of the name of Gray, which formerly resided here, and in the reign of Edward III. demised it to some students in the law; but it is said to have been afterwards conveyed to the monks of Shene, near Richmond in Surry, who leased it to the society of the Inn. It was held by this tenure till the dissolution of the monasteries, when Henry VIII. granted it to the society in fee-farm. This inn consists chiefly of two quadrangles, and has an old hall well built of timber, with a chapel in the Gothic style. Here is also a good library, and the Inn is accommodated with a spacious garden.

111
Lincoln's Inn.

Lincoln's Inn, another of the four principal inns of court, was originally the palace of Ralph Neville bishop of Chichester, and chancellor of England about the year 1226. It afterwards devolved to the earl of Lincoln, who converted it into a court for the students of law about the year 1310. From him it received the name of Lincoln's-inn, and consisted only of what is now called the old square, which is entered from Chancery-lane. At present this square contains, besides buildings for the lawyers, a large hall where the lord chancellor hears causes in the sittings after term. To this inn belongs likewise a fine garden, which has lately been diminished by the building of some large and commodious offices, for the use of the six clerks in the court of Chancery, &c.

152
Charter-house.

In the parish of St James, Clerkenwell, is an hospital called the *Charter-house*, which is a corruption of the word *chartreux*, a name formerly used for a convent or priory of the Carthusians, which this place formerly was. After the dissolution of monasteries it fell to the earl of Suffolk, who disposed of it to Thomas Sutton, Esq; a citizen of London, in the time of king James I. for L.13,000. The purchaser intending it for an hospital, applied to the king for a patent, which he obtained in 1611, and the grant was confirmed by parliament in 1623. Mr Sutton having expended L.7000 in fitting up the buildings, gave it the name of king James's hospital, and endowed it with lands to the amount of near L.4500 a-year, for the maintenance of 80 gentlemen, merchants or soldiers, who should be reduced to indigent circumstances; and 40 boys, to be instructed in classical learning. The men are provided with handsome apartments, and all the necessaries of life except clothes; instead of which each of them is allowed a gown, and L.7 a-year. Of the boys, 29 are at a proper time sent to the university, where each has an allowance of L.20 a-year for eight years. Others, who are judged more fit for trade, are put out apprentices, and the sum of L.40 is given with each of them. As a farther encouragement to the scholars, there are nine ecclesiastical preferments in the gift of the governors. It is also by

London.

the recommendation of the latter that all pensioners and youths are received into the hospital. They consist of 16, of which number the king is always one, and the others are generally noblemen of the first rank. To this hospital belong a master, a preacher, two schoolmasters, a physician, a regifter, a receiver, a treasurer, a steward, an auditor, and other officers; and the annual revenues of it being now increased to upwards of L.6000, five men and four boys have been added to the original number.

153
Alms-house
Hospital.

In the parish of St Luke stands the Haberdashers alms-house, or *Alke's Hospital*, so called from having been erected by the company of haberdashers, pursuant to the will of Robert Alke, Esq; one of their members, who left L.30,000 for the building and the relief of 20 poor members of the company; besides the maintenance and education of 20 boys, sons of decayed freemen of the same company. This is a large edifice of brick and stone, 400 feet long, with a piazza in front 340 feet in length, consisting of stone columns of the Tuscan order. In the middle of the building is a chapel, adorned with columns, entablatures, and pediment, of the Ionic order; and under the pediment is a niche, with a statue of the founder. In the same parish is the Iron-mongers hospital, likewise a large building.

In the parish of St Mary, Whitechapel, stands the *London Hospital*, for the reception of the sick. It is a large building, and was erected a few years since by voluntary contribution. Here are also some considerable alms-houses.

154
Houses of
the Nobility.

Within the precincts of Westminster are several stately houses belonging to the nobility, some of which have been already mentioned. Of the others, the most remarkable at present are, Burlington-house, Devonshire-house, Egremont-house, and Bedford-house; Carlton-house, the magnificent abode of the prince of Wales, and the superb residence erected by the duke of York between the Treasury and the Horse-guards.

155
British
Museum.

To these may be added, *Montagu-house* (now the British Museum); which was built on a French plan by the first duke of Montagu, who had been ambassador in France. The staircase and ceilings were painted by Rousseau and La Fosse: the apotheosis of Iris, and the assembly of the gods, are by the last. It was purchased of the duke's heirs by parliament, for uniting together the Royal, Cottonian, Harleian, Sloanian, and other collections of books, MSS. coins, antiquities, subjects in natural history, &c. &c. for the public use, for which it is excellently adapted. The first of these libraries contains the books and MSS. of our princes from Henry VII. to Charles II.; the second the MSS. collected by Sir Robert Cotton, his son, and grandson Sir John, which last gave it to the public by act 12 and 13 William III. c. 7. The Harleian collection of MSS. was formed by Edward earl of Oxford, and purchased by government in 1753, at the same time with the library, MSS. and natural curiosities of Sir Hans Sloane. This last cost Sir Hans L.50,000; and he left it, by will, to the use of the public, on condition that the parliament would pay L.20,000 to his executors. It comprehends an amazing number of curiosities: among which are, the library, including books of drawings, MSS. and prints,

amounting

London.

amounting to about 50,000 volumes; medals and coins, ancient and modern, 20,000; cameos and intaglios, about 700; seals, 268; vessels, &c. of agate, jasper, &c. 542; antiquities, 1125; precious stones, agates, jasper, &c. 2256; metals, minerals, ores, &c. 2725; crystal, spars, &c. 1864; fossils, flints, stones, 1275; earths, sands, salts, 1035; bitumens, sulphurs, ambers, &c. 399; tales, mice, &c. 388; corals, sponges, &c. 1421; testacea, or shells, &c. 5843; echini, echinits, &c. 659; alteriæ trochi, eutrochi, &c. 241; crustacea, crabs, lobsters, &c. 363; stella maris; star-fishes, &c. 173; fish, and their parts, &c. 1555; birds, and their parts, eggs, and nests, of different species, 1172; quadrupeds, &c. 1886; vipers, serpents, &c. 521; insects, &c. 5439; vegetables, 12,506; hortus ficus, or volumes of dried plants, 334; humani, as calculi, anatomical preparations, 750; miscellaneous things, natural, 2098; mathematical instruments, 55. A catalogue of all the above is written in a number of large volumes. It is a large and magnificent building; and has behind it a garden, consisting nearly of nine acres.

156
Principal
squares, &c.

Besides a great number of spacious streets, which are daily increasing, this part of the metropolis is ornamented with several magnificent squares, viz. Grosvenor-square, Berkeley-square, Portman-square, Cavendish-square, Hanover-square, St James's-square, Soho-square, Bloombury-square, Queen's-square, Lincoln's-Inn-fields, Leicester-square, Red-Lion-square, some of which have been particularly described; not to mention others that are at present building. In general, the new buildings in the liberty of Westminster have increased to a prodigious degree; inasmuch that they reach as far as Marybone to the north, Piccadilly to the south, and Hyde-Park-wall to the west.

157
London
anciently
inconven-
ient and un-
healthy.

Before the conflagration in 1666, LONDON (which, like most other great cities, had arisen from small beginnings) was totally inelegant, inconvenient, and unhealthy, of which latter misfortune many melancholy proofs are authenticated in history, and which, without doubt, proceeded from the narrowness of the streets, and the inaccountable projections of the buildings, that confined the putrid air, and joined with other circumstances, such as the want of water, rendered the city seldom free from pestilential devastation. The fire which consumed the greatest part of the city, dreadful as it was to the inhabitants at that time, was productive of consequences which made ample amends for the losses sustained by individuals; a new city arose on the ruins of the old; but, though more regular, open, convenient, and healthful, than the former, yet it by no means answered to the characters of magnificence or elegance, in many particulars; and it is ever to be lamented (such was the insatiation of those times), that the magnificent, elegant, and useful plan of the great Sir Christopher Wren, was totally disregarded, and sacrificed to the mean and selfish views of private property; views which did irreparable injury to the citizens themselves and to the nation in general: for had that great architect's plan been followed, what has often been asserted must have been the result; the metropolis of this kingdom would incontestably have been the most magnificent and elegant city in the

universe, and of consequence must, from the prodigious report of foreigners of distinction and taste who would have visited it, have become an inexhaustible fund of riches to this nation. But as the deplorable blindness of that age has deprived us of so valuable an acquisition, it is become absolutely necessary that some efforts should be made to render the present plan in a greater degree answerable to the character of the richest and most powerful people in the world.

The plan of London, in its present state, will in many instances appear to very moderate judges to be as injudicious a disposition as can easily be conceived for a city of trade and commerce, on the borders of so noble a river as the Thames. The wharfs and quays on its banks are extremely mean and inconvenient; and the want of regularity and uniformity in the streets of the city of London, and the mean avenues to many parts of it, are also circumstances that greatly lessen the grandeur of its appearance. Many of the churches and other public buildings are likewise thrust up in corners, in such a manner as might tempt foreigners to believe that they were designed to be concealed. The improvements of the city of London for some years past have, however, been very great; and the new streets, which are numerous, are in general more spacious, and built with greater regularity and elegance.

158
its plan still
defective.

The very elegant and necessary method of paving and enlightening the streets is also felt in the most sensible manner by all ranks and degrees of people. The roads are continued for several miles around upon the same model; and, exclusive of lamps regularly placed on each side, at short distances, are rendered more secure by watchmen stationed within call of each other. Nothing can appear more brilliant than those lights when viewed at a distance, especially where the roads run across; and even the principal streets, such as Pall Mall, New Bond-street, Oxford-street, &c. convey an idea of elegance and grandeur.

159
Great im-
provements.

London, then, in its large sense, including Westminster, Southwark, and part of Middlesex, forms one great metropolis, of vast extent and of prodigious wealth. When considered with all its advantages, it is now what ancient Rome once was; the seat of liberty, the encourager of arts, and the admiration of the whole world. It is the centre of trade; has an intimate connection with all the counties in the kingdom; and is the grand mart of the nation, to which all parts send their commodities, from whence they are again sent back into every town in the nation and to every part of the world. From hence innumerable carriages by land and water are constantly employed: and from hence arises that circulation in the national body which renders every part healthful, vigorous, and in a prosperous condition; a circulation that is equally beneficial to the head and the most distant members. Merchants are here as rich as noblemen; witness their incredible loans to government; and there is no place in the world where the shops of tradesmen make such a noble and elegant appearance, or are better stocked.

160
Wealth and
grandeur of
this vast
metropolis.

The Thames, on the banks of which London is situated, is a river which, though not the largest, is the richest and most commodious for commerce of any river.

161
its excellent
situation
for com-
merce.
in

London

in the world. It is continually filled with fleets, failing to or from the most distant climates : and its banks, from London-bridge to Blackwall, form almost one continued great magazine of naval stores ; containing three large wet-docks, 32 dry-docks, and 33 yards for the building of ships for the use of the merchants ; besides the places allotted for the building of boats and lighters, and the king's yards lower down the river for the building of men of war. As the city is about 60 miles distant from the sea, it enjoys, by means of this beautiful river, all the benefits of navigation, without the danger of being surpris'd by foreign fleets, or of being annoyed by the moist vapours of the sea. It rises regularly from the water-side, and, extending itself on both sides along its banks, reaches a prodigious length from east to west in a kind of amphitheatre towards the north, and is continued for near 20 miles on all sides, in a succession of magnificent villas and populous villages, the country-seats of gentlemen and tradesmen ; whither the latter retire for the benefit of fresh air, and to relax their minds from the hurry of business. The regard paid by the legislature to the property of the subject, has hitherto prevented any bounds being fixed for its extension.

162
Its great
extent.

The irregular form of London makes it difficult to ascertain its extent. However, its length from east to west is generally allowed to be above seven miles from Hyde-park corner to Poplar ; and its breadth in some places three, in others two, and in others again not much above half a mile. Hence the circumference of the whole is almost 18 miles ; or, according to a later measurement, the extent of continued buildings is 35 miles two furlongs and 39 rods. But it is much easier to form an idea of the large extent of a city so irregularly built by the number of the people, who are computed to be near a million ; and from the number of edifices devoted to the service of religion.

163
General
enumeration
of
churches,
chapels, &c.

Of these, beside St Paul's cathedral and the collegiate church at Westminster, here are 102 parish-churches, and 69 chapels, of the established religion : 21 French protestant chapels ; 11 chapels belonging to the Germans, Dutch, Danes, &c. ; 26 independent meetings ; 34 presbyterian meetings ; 20 baptist meetings ; 19 popish chapels, and meeting-houses for the use of foreign ambassadors and people of various sects ; and three Jews synagogues. So that there are 305 places devoted to religious worship in the compass of this vast pile of buildings, without reckoning the 21 out-parishes usually included in the bills of mortality, and a great number of methodist tabernacles.

164
Hospitals,
schools,
houses, &c.

There are also in and near this city 100 alms-houses, about 20 hospitals and infirmaries, 3 colleges, 10 public prisons, 15 flesh-markets ; one market for live cattle ; two other markets more particularly for herbs ; and 23 other markets for corn, coals, hay, &c. ; 15 inns of court, 27 public squares, besides those within single buildings, as the Temple, &c. ; 3 bridges, 55 halls for companies, 8 public schools, called free-schools ; and 131 charity-schools, which provide education for 5034 poor children ; 207 inns, 447 taverns, 551 coffee-houses, 5975 alehouses ; 1000 hackney-coaches ; 400 ditto chairs ; 7000 streets, lanes, courts, and alleys, and 150,000 dwelling-houses, containing, as has been already observed, about 1,000,000 inhabitants ;

165
Number of
inhabitants.

who, according to a moderate estimate, are supposed to consume the following provisions weekly :

London

	L.	s.	d.
1000 Bullocks, at 6l. a-piece	6000	0	0
6000 Sheep, at 12s. a-piece	3600	0	0
2000 Calves, at 1l. 4s. a-piece	2400	0	0
3000 Lambs, at 8s. a-piece, for six months	1200	0	0
1500 Hogs in pork and bacon, at 20s. for six months	1500	0	0
2000 Pigs, at 2s. 6d. a-piece	250	0	0
1000 Turkeys, at 3s. 6d. a-piece, for six months	175	0	0
1000 Geese, at 2s. 6d. a-piece, for six months	125	0	0
2000 Capons, at 1s. 8d. a-piece	166	13	2
500 Dozens of Chickens at 9s. per dozen	225	0	0
4300 Ducks, at 9d. a-piece	161	5	4
1500 Dozen of rabbits, at 7s. per dozen, for eight months	525	0	0
2000 Dozen of pigeons, at 2s. per dozen, for eight months	200	0	0
700 Dozen of wild-fowl, of several sorts, for six months	250	0	0
In salt and fresh fish, at 1d. a-day, for half a million of people for one week	14,583	6	8
In bread of all sorts, white and brown at 1d. a-day, for one million of people for a week	29,166	13	4
300 Tons of wine, of all sorts, at 50l. a ton, one sort with another, for one week	15,000	0	0
In milk, butter, cheese, &c. at 1d. a-day, for a million of people for a week	29,166	13	4
In fruit of all sorts, at one farthing a-day, for a million of people for a week	7291	13	4
In eggs of hens, ducks, geese, &c. at half a farthing a-day, for a million of people for a week	13645	16	4
In beer and ale, strong and small, at 2d. a-day, for a million of people for a week	58,333	6	8
In sugar, plums, and spice, and all sorts of grocery, at a halfpenny a-day, for a million of people for a week	14,583	6	8
In wheat-flour, for pies and puddings, oatmeal and rice, &c. at half a farthing a-day, for a million of people for a week	3645	16	8
In salt, oil, vinegar, capers, olives, and other sauces, at half a farthing a-day, for a million of people for a week	3645	16	8
In roots and herbs of all sorts, both for food and physic, at half a farthing a-day, for a million of people for a week	3645	11	8
In sea-coal, charcoal, candles, and firewood, of all sorts, at 1d. a-day, for a million of people for a week	29,166	13	4

166

London.
Londonderry.

In paper of all sorts (a great quantity being used in printing) quills, pens, ink, and wax, at a farthing a-day, for amillion of people for a week

In tobacco, pipes, and snuff, at half a farthing a-day, for a million of people for a week

In cloathing, as linen and woollen, for men, women, and children, shoes, stockings, &c. at 3s. 6d. per week, for a million of people for a week

Expences for horse-meat, in hay, oats, beans, 1000 load of hay a-week, at 40s. a-load, comes to 2000l. in oats and beans the like value, 2000l. which is in all, for one week

Cyder, mum, brandy, strong waters, coffee, chocolate, tea, &c. at 1d. a-day, for a million of people for one week

The common firing is pit-coal, commonly called *fire-coal*, of which there are consumed upwards of 766,880 chaldrons every year. The annual consumption of oil in London and Westminster for lamps, amounts to 400,000l. In 1787, the quantity of porter brewed in London for home-consumption and foreign exportation, amounted to 1,176,856 barrels.

This great and populous city is happily supplied with abundance of fresh water from the Thames and the New River; which is not only of inconceivable service to every family, but by means of fire-plugs every where dispersed, the keys of which are deposited with the parish-officers, the city is in a great measure secured from the spreading of fire; for these plugs are no sooner opened, than there are vast quantities of water to supply the engines. This plenty of water has been attended with another advantage, it has given rise to several companies, who insure houses and goods from fire; an advantage that is not to be met with in any other nation on earth: the premium is small, and the recovery in case of loss is easy and certain. Every one of these offices keep a set of men in pay, who are ready at all hours to give their assistance in case of fire; and who are on all occasions extremely bold, dexterous, and diligent: but though all their labours should prove unsuccessful, the person who suffers by this devouring element has the comfort that must arise from a certainty of being paid the value (upon oath) of what he has insured.

The places for diversion are, Vauxhall, Ranelagh-gardens, the two play-houses, one of them rebuilding, the Pantheon lately burnt down; and the little theatre in the Hay-market, with Sadlers-wells, Hughes's Circus, and Aisle's Royal-Grove, &c. The finest repositories of rarities and natural history, are Sir Hans Sloane's, in the British Museum, already described; and another collected by the late Sir Ashton Lever, now the private property of Mr Parkinson, and deposited in proper apartments for public inspection, near the fourth end of Blackfriars bridge.

LONDONDERRY, or COLERAINE, a county of Ireland, in the province of Ulster. It is bounded on the fourth and south-west by the county of Tyrone; N^o 187.

by Antrim on the east, from which it is parted by the river Bann; by Donegal on the west; and that county and the Deucalidonian ocean on the north. Its greatest length is about 36 miles, its breadth 30, containing about 251,510 acres. The bogs and heaths of this county are manured with sea-shells, as those of Donegal. Like that, too, it is pretty champaign, and not unfruitful. It is particularly noted for a very clear river called the *Bann*, abounding with salmon, a fish said to delight in limpid streams. This river, to distinguish it from a lesser of the same name, is called the *Greater or Lower Bann*. In order to cultivate, settle, and civilize this county, king James I. granted it, by letters-patent, to a society, by the name of the *Governor and Assistants at London of the new plantation of Ulster in the realm of Ireland*. It contains six baronies; and, besides the two knights of the shire, sends to parliament two members for the city of Londonderry, and two each for Coleraine and Newton-Lisnawady or Lamneevady.

LONDONDERRY, or Derry, the capital of the county, and the see of a bishop, stands at the bottom of Lough-Foyle. This city has a very good port, to which ships of the greatest burden have access, and a considerable trade. It will be ever famous for the gallantry and perseverance with which it defended itself in three memorable sieges, in defiance of the greatest hardships and discouragements, namely, 1st, In 1641, when the rebels could not reduce it either by fraud or force. 2dly, In 1649, when it was besieged by the Lord Ardes, and reduced almost to extremity by famine, till at last relieved by troops sent from England. 3dly, When it held out against the French and Irish from the 7th of December 1688 to the last day of July 1689, though it was neither well fortified nor provided with a garrison or stores of provision and ammunition, and hardly any attempt made to relieve it during so long a time. Though the city is 20 miles up the river, yet very large ships can come up to the quay, where there are four or five fathoms of water. It is now well fortified with a strong wall, besides outworks; and along the banks of the river are several castles and a fort. This city is of no great antiquity, having been built and planted in the reign of James I. by a colony sent by the society abovementioned. The trade of the town is very considerable, having not only a large share in the herring-fishery, but sending ships also to the West-Indies, New-England, and Newfoundland, for which they are so advantageously situated, that a vessel bound from thence to America often arrives there before a London ship can get clear of the soundings, or arrive in the latitude of Londonderry. Tho' there are a great many shallows in Lough-Foyle, which serve it instead of a road; yet they are easily avoided, as there are deep channels between them. Those points called *Emilstone*, *Rystrhull*, or *Caldy-head*, which lie a little to the west of the mouth of the harbour, are counted the most northerly of Ireland, lying in lat. 55. 20. The inhabitants of this city are almost all Protestants. It gave title of *earl* and *baron* to a branch of the family of Pitt, which became extinct in 1764; but part of the title was revived in Robert Stewart, who was created Baron Londonderry in 1789. A late traveller says, "Derry is, per-

London.
derry.

167
Firing,
porter, &c.

168
Supply of
water.

169
Insural
companies.

170
Places of
diversion,
&c.

Long. haps, the cleanest, best built, and most beautifully situated town in Ireland; and, excepting Corke, as convenient as any for commerce, foreign and domestic." The lake almost furrounds it; and the whole ground-plot both of it and its liberties belongs to the 12 great companies of London. Great quantities of salmon, salted and barrelled, are exported from hence to America.

LONG, an epithet given to whatever exceeds the usual standard of length.

Long-Boat, the largest and strongest boat belonging to any ship. It is principally employed to carry great burdens, as anchors, cables, ballast, &c. See *Boat*.

LONG (Roger), D. D. master of Pembroke-hall in Cambridge, Lowndes's professor of astronomy in that university, rector of Cherryhinton in Huntingdonshire, and of Bradwell *juxta mare* in Essex, was author of a well-known and much approved treatise of astronomy, and the inventor of a remarkably curious astronomical machine, thus described by himself. "I have, in a room lately built in Pembroke-hall, erected a sphere of 18 feet diameter, wherein above 30 persons may fit conveniently; the entrance into it is over the fourth pole by six steps; the frame of the sphere consists of a number of iron meridians, not complete semicircles, the northern ends of which are screwed to a large round plate of brass, with an hole in the centre of it; thro' this hole, from a beam in the ceiling, comes the north pole, a round iron rod, about three inches long, and supports the upper parts of the sphere to its proper elevation for the latitude of Cambridge; the lower part of the sphere, so much of it as is invisible in England, is cut off; and the lower or southern ends of the meridians, or truncated semicircles, terminate on, and are screwed down to, a strong circle of oak, of about 13 feet diameter; which, when the sphere is put into motion, runs upon large rollers of lignum vitæ, in the manner that the tops of some windmills are made to turn round. Upon the iron meridians is fixed a zodiac of tin painted blue, whereon the ecliptic and heliocentric orbits of the planets are drawn, and the constellations and stars traced: the Great and Little Bear and Draco are already painted in their places round the north pole; the rest of the constellations are proposed to follow: the whole is turned round with a small winch, with as little labour as it takes to wind up a jack, though the weight of the iron, tin, and wooden circle, is about 1000 pounds. When it is made use of, a planetarium will be placed in the middle thereof. The whole, with the floor, is well supported by a frame of large timber." Thus far Dr Long, before this curious piece of mechanism was perfected. Since the above was written, the sphere has been completely finished; all the constellations and stars of the northern hemisphere, visible at Cambridge, are painted in their proper places upon plates of iron joined together, which form one concave surface. Dr Long published a Commencement Sermon 1728; and an answer to Dr Galley's pamphlet on Greek Accents; and died December 16th 1770, at the age of 91. As the materials for this article are scanty, we shall subjoin, from the Gentleman's Magazine †, a few traits of him, as delineated in 1769 by Mr Jones. "He is now in the 88th year of his age, and for his years vegete and

active. He was lately (in October) put in nomination for the office of vice-chancellor. He executed that trust once before, I think in the year 1737; a very ingenious person, and sometimes very facetious. At the public commencement in the year 1713, Dr Greene (master of Bennet college, and afterwards bishop of Ely) being then vice chancellor, Mr Long was pitched upon for the tripos-performance; it was witty and humorous, and has passed through divers editions. Some that remembered the delivery of it, told me, that in addressing the vice-chancellor (whom the university was usually styled *Mist Greene*), the tripos-orator, being a native of Norfolk, and assuming the Norfolk dialect, instead of saying, *Domine Vice-Cancellarie*, did very archly pronounce the words thus, *Domina Vice-Cancellaria*; which occasioned a general smile in that great auditory. His friend the late Mr Bonfoy of Ripton told me this little incident, 'That he and Dr Long walking together in Cambridge in a dully evening, and coming to a short *post* fixed in the pavement, which Mr B. in the midst of chat and inattention, took to be a *boy* standing in his way, he said in a hurry, 'Get out of my way, boy.' 'That *boy*, Sir,' said the Doctor very calmly and slyly, is a *poet-boy*, who turns out of his way for nobody.'—I could recollect several other ingenious repartees if there were occasion. One thing is remarkable, he never was a hale and hearty man, always of a tender and delicate constitution, yet took great care of it. His common drink water; he always dined with the fellows in the hall. Of late years he has left off eating flesh-meats: in the room thereof, puddings, vegetables, &c. sometimes a glass or two of wine."

LONGEVITY, length of life.

From the different longevities of men in the beginning of the world, after the flood, and in these ages, Mr Derham draws an argument for the interposition of a divine Providence.

Immediately after the creation, when the world was to be peopled by one man and one woman, the ordinary age was 900 and upwards.—Immediately after the flood, when there were three persons to stock the world, their age was cut shorter, and none of those patriarchs, but Shem, arrived at 500. In the second century we find none that reached 200; in the third, none but Terah that came to 200 years; the world, at least a part of it, by that time being so well peopled, that they had built cities, and were cantoned out into different nations.—By degrees, as the number of people increased, their *longevity* dwindled, till it came down at length to 70 or 80 years; and there it stood, and has continued to stand ever since the time of Moses.—This is found a good medium, and by means hereof the world is neither overstocked, nor kept too thin; but life and death keep a pretty equal pace.

That the common duration of man's life has been the same in all ages since the above period, is plain both from sacred and profane history. To pass by others, Plato lived to 81, and was accounted an old man: and the instances of *longevity* produced by Pliny L. vii. c. 48. as very extraordinary, may most of them be matched in modern histories.—In the following Tables are collected into one point of view the most memorable instances of long-lived persons of whose age

† For 1783, p. 983.

Longevity. we have any authentic records. The first and second gill; who inserted them, accompanied by a third, together with a number of useful observations, in the first volume of the Memoirs of the Manchester Literary Society.

Names of the persons.	Ages	Places of Abode.	Living or Dead.
Thomas Parre	152	Shropshire	Died November 16. 1635. Phil. Trans. N ^o 44.
Henry Jenkins	169	Yorkshire	Died December 8. 1670. Phil. Trans. N ^o 221.
Robert Montgomery	126	Ditto	Died in — — 1670.
James Sands	140	Staffordshire	} Do Fuller's Worthies
His Wife	120	Ditto	} p. 47.
Countess of Desmond	140	Ireland	Raleigh's Hist. p. 166.
—Eccleston	143	Ditto	Died — — 1691. (A)
J. Sagar	112	Lancashire	— — — 1668. (B)
—Laurence	140	Scotland	Living — — (C)
Simon Sack	141	Trionia	Died May 30. 1764.
Col. Thomas Winflow	146	Ireland	— Aug. 26. 1766.
Francis Confit	150	Yorkshire	— Jan. — 1768.
Christ. J. Drakenberg	146	Norway	— June 24. 1770. (D)
Margaret. Forster	136	Cumberland	} Both living 1771.
—her daughter	104	Ditto	Died Feb. 6. 1769.
Francis Bons	121	France	Living — — 1777. (E)
John Brookey	134	Devonshire	Died Aug. 15. 1656 (F)
James Bowels	152	Killingworth	— March, 1774. (G)
John Tice	125	Worcestershire	— Feb. 27. 1766. (H)
John Mount	136	Scotland	— June — 1776. (I)
A. Goldsmith	140	France	— — — 1776. (K)
Mary Yates	128	Shropshire	— April 5. 1766. (L)
John Bales	126	Northampton	— Aug. 16. 1780. (M)
William Ellis	130	Liverpool	Living Oct. 5. 1780. (N)
Louifa Truxo, a Negress	175	Tucomea, S. America	Lynche's Guide to Health
Margaret Patten	138	Lockneugh near Paisley	Died Oct. 10. 1780.
Janet Taylor	108	Fintray, Scotland	Lynche's Guide to Health
Richard Lloyd	133	Montgomery	Died Feb. 19. 1781 (O)
Sufannah Hilliar	100	Piddington, Northampsh.	— April 5. 1775 (P)
Ann Cockbolt	105	Stoke-Bruerne, <i>Id.</i>	— March 17. 1781 (Q)
James Hayley	112	Middlewich, Cheshire	
William Walker, aged 112,	not mentioned above, who was a foldier at the battle of Edge-hill.		

If we look back to an early period of the Christian era, we shall find that Italy has been, at least about that time, peculiarly propitious to longevity. Lord Bacon observes that the year of our Lord 76, in the reign of Vespasian, was memorable; for in that year was a taxing which afforded the most authentic method of knowing the ages of men. From it, there were found in that part of Italy lying between the Apennine mountains and the river Po 124 persons who either equalled or exceeded 100 years of age, namely:

54 persons of 100 Years each.

57 — — 110

2 — — 125

	4 persons of 130 Years.
	4 — — 136
	3 — — 140
In Parma	3 — — 120
	2 — — 130
In Brussels	1 — — 125
In Placentia	1 — — 131
In Faventia	1 — — 132
	6 — — 110
	4 — — 120
In Rimino	1 — — 150 Years, viz.

Marcus Aponius.
Mr

(A) Fuller's Worthies, p. 140.

(B) Phil. Trans. abridged by Lowthorp, Vol. III. p. 30, 6.

(C) Derham's Physico-Theology, p. 173.

(D) Annual Register.

(E) Daily Advertiser, Nov. 18, 1777.

(F) Warwickshire.

(G) Daily Advertiser, March 1774.

(H) Morning Post, Feb. 29. 1776.

(I) Daily Advertiser, June 24. 1776.

(K) Daily Advertiser, Aug. 22. 1776.

(L) See Inscription in the portico of All-Saints church.

(M) London Even. Post, Aug. 22. 1780.

(N) London Chronicle, Oct. 5. 1780.

(O) Northamp. Mercury, Feb. 19. 1781.

(P) Well known to persons of credit of Northampton.

(Q) Gen. Evening Post, March 24. 1781.

Longevity. Mr Carew, in his survey of Cornwall, assures us, that it is no unusual thing with the inhabitants of that county to reach 90 years of age and upwards, and even to retain their strength of body and perfect use of their senses. Besides Brown, the Cornish beggar, who lived to 120, and one Polezew to 130 years of age, he remembered the decease of four persons in his own parish, the sum of whose years, taken collectively, amounted to 340. Now, although longevity evident-

ly prevails more in certain districts than in others, yet it is by no means confined to any particular nation or climate; nor are there wanting instances of it, in almost every quarter of the globe, as appears from the preceding as well as the subsequent Tables; which might have been considerably enlarged, had it appeared necessary; but we have only added, in the last, three recent instances that are peculiarly remarkable.

Names of the Persons.	Age.	Places of Abode.	Where recorded.
Hippocrates, Physician	104	Island of Cos	Lynche on Health, chap. 3.
Democritus, Philosopher	109	Abdera	Bacon's History, 1095.
Galen, Physician	140	Pergamus	Voss. Inst. or lib. 3.
Albuna, Marc	150	Ethiopia	Hakewell's Ap. lib. 1.
Dumitur Raduly	140	Haromfzeck, Transylvania	Died Jan. 18, 1782. Gen. Gazetteer, April 4 th .
Titus Fillonius	150	Bononia	Fulgosius, lib. 8.
Abraham Paiba	142	Charlestown, South-Car.	General Gazetteer
L. Tertulla	137	Arminium	Bulgosius lib. 8.
Lewis Cornaro	100	Venice	Bacon's Hist. of Life, p. 134.
Robert Blakeney, Esq.	114	Armagh, Ireland	General Gazetteer.
Margaret Scott	125	Dalkeith, Scotland	Inscrip. on her Tomb there.
W. Gullstone	140	Ireland	Fuller's Worthies.
J. Bright	105	Ludlow	Lynche on Health.
William Postell	120	France	Bacon's History, p. 134.
Jane Reeves	103	Essex	St J. Chron. June 14, 1781.
W. Paulet, Marquis of Winchester	106	Hampshire	Baker's Chron. p. 502.
John Wilfon	116	Suffolk	Gen. Gaz. Oct. 29, 1782.
Patrick Wian	115	Lebury, Northumber ^d .	Plemp. Fundamded, § 4. c. 8.
M. Laurence	140	Orcades	Buchanan's Hist. of Scot.
Evan Williams	145	Caermarthen work-house, still alive	Gen. Gazetteer, Oct. 12, 1782.
John Jacobs (a)	121	Mount Jura	All the public prints, Jan. 1790.
Matthew Tait (s)	123	Auchinleck, Airshire.	Died Feb. 19, 1792. Edin. Even. Cour. Mar. 8, 1792.
Donald Macleod (t)	104	Isle of Sky. Alive Jan. 1792.	All the public prints at the end of 1790; and <i>Memoirs</i> , &c.

M m 2

The

(a) This man, in 1789, at the age of 120, quitted his native hills, and from the summit of Mount Jura undertook a journey to Versailles, to behold and return thanks to the National Assembly for the vote which had freed him and his poor countrymen from the feudal yoke. In the early part of his life, he was a servant in the family of the prince de Beaumont. His memory continued good to the last day of his life; and the principal inconveniences which he felt from his great age were, that his sight was weakened, and the natural heat of his body was so diminished, that he shivered with cold in the middle of the dog-days if he was not sitting by a good fire. This old man was received in the body of the house by the National Assembly, indulged with a chair, and directed to keep on his hat lest he should catch cold if he was to sit uncovered. A collection was made for him by the members, which exceeded 500l. Sterling; but he lived not to return to Mount Jura. He was buried on Saturday the 31st of January 1790, with great funeral pomp, in the parish-church of St Eustace at Paris.

(s) He served as a private at the taking of Gibraltar in 1704.

(t) *Memoirs of the Life and gallant Exploits of the Old Highlander Serjeant Donald Macleod*, &c. published Jan. 1791, in the 103^d year of his age.—This old gentleman, for it appears that he really is a gentleman both by birth and by behaviour, was born in the year of the Revolution, in the parish of Bracadill, in the isle of Sky and county of Inverness, North Britain. He is a cadet of the family of Ulinish in Sky; and descended, through his mother, from Macdonald of Slate, the ancestor of the present Lord Macdonald. The earlier part of his life coincided with the famine of seven years in Scotland; which was so great as to suggest, even to the patriotic Mr Fletcher, the idea of the people selling themselves as slaves for immediate subsistence. He was bred in the midst of want and hardships, cold, hunger, and for the years of his apprenticeship with a mason and stone-cutter in Inverness, in incessant fatigue. He enlisted, when a boy, in the Scottish service, in the town of Perth, in the last year of the reign of King William. The regiment into which he enlisted

Longevity.

The Antediluvians are purposely omitted, as bearing too little reference to the present race of mortals, to afford any satisfactory conclusions; and as they have been already taken notice of in a separate article; (see ANTEDILUVIANS). As the improbable stories of some persons who have almost rivalled them in modern times, border too much upon the marvellous to find a place in these tables, the present examples are abundantly sufficient to prove, that longevity does not depend, so much as has been supposed, on any particular climate, situation, or occupation in life: for we see, that it often prevails in places where all these are extremely dissimilar; and it would, moreover, be very difficult, in the histories of the several persons above mentioned, to find any circumstance common to them all, except, perhaps, that of being born of healthy parents, and of being inured to daily labour, temperance, and simplicity of diet. Among the inferior ranks of mankind, therefore, rather than among the sons of ease and luxury, shall we find the most numerous instances of longevity; even frequently, when other external circumstances seem extremely unfavourable: as in the case of the poor sexton at Peterborough, who, notwithstanding his unpromising occupation among dead bodies, lived long enough to bury two crowned heads, and to survive two complete generations. The livelihood of Henry Jenkins and old Parre, is said to have consisted chiefly of the coarsest fare, as they depended on precarious alms. To which may be added the remarkable instance of Agnes Milbourne, who, after bringing forth a numerous offspring, and being obliged, through extreme indigence, to pass the latter part of her life in St Luke's workhouse, yet reached her 106th year in that fordid and unfriendly situation. The plain diet and invigorating employments of a country life are acknowledged on all hands to be highly conducive to health and longevity, while the luxury and refinements of large cities are allowed to be equally destructive to the human species; and this consideration alone, perhaps, more than

counterbalances all the boasted privileges of superior Longevity. elegance and civilization resulting from a city life.

From country villages, and not from crowded cities, have the preceding instances of longevity been chiefly supplied. Accordingly it appears, from the London bills of mortality, during a period of 30 years, viz. from the year 1728 to 1758, the sum of the deaths amounted to 750,322, and that, in all this prodigious number, only 242 persons survived the 100th year of their age! This overgrown metropolis is computed by Dr Price to contain a ninth part of the inhabitants of England, and to consume annually 7000 persons, who remove into it from the country every year, without increasing it. He moreover observes, that the number of inhabitants in England and Wales has diminished about one-fourth part since the Revolution; and so rapidly of late, that in 11 years, near 200,000 of our common people have been lost. If the calculation be just, however alarming it may appear in a national view, there is this consolation, when considered in a philosophical light, that without partial evil, there can be no general good; and that what a nation loses in the scale of population at one period, it gains at another; and thus probably, the average number of inhabitants on the surface of the globe continues at all times nearly the same. By this medium, the world is neither overstocked with inhabitants nor kept too thin, but life and death keep a tolerably equal pace. The inhabitants of this island, comparatively speaking, are but as the dust of the balance; yet instead of being diminished, we are assured by other writers, that within these 30 years they are greatly increased.

The desire of self-preservation, and of protracting the short span of life, is so intimately interwoven with our constitution, that it is justly esteemed one of the first principles of our nature, and, in spite even of pain and misery, seldom quits us to the last moments of our existence. It seems, therefore, to be no less our duty than our interest, to examine minutely into the

various

was the Scots Royals, commanded by the earl of Orkney. That old military corps, at that time, used bows and arrows as well as swords, and wore steel caps. He served in Germany and Flanders under the duke of Marlborough, under the duke of Argyle in the rebellion 1715, in the Highland Watch, or companies raised for enforcing the laws in the Highlands; in the same companies when, under the name of the 42d regiment, they were sent abroad to Flanders, to join the army under the duke of Cumberland; in the same regiment in Ireland, and on the breaking out of the French war, 1757, in America. From the 42d he was draughted to act as a drill sergeant in the 78th regiment, in which he served at the reduction of Louisbourg and Quebec: After this he became an out-pensioner of Chelsea Hospital. But such was the spirit of this brave and hardy veteran, that he served in 1761 as a volunteer in Germany under the marquis of Granby; and offered his services in the American war to Sir Henry Clinton; who, though he declined to employ the old man in the fatigues and dangers of war, treated him with great kindness, allowed him a liberal weekly pension out of his own pocket, and sent him home in a ship charged with dispatches to government.—The sergeant, “as his memory, according to the observation of his biographer, is impaired, does not pretend to make an exact enumeration of all his offspring: but he knows of 16 sons now living, 14 of whom are in the army and navy, besides daughters; the eldest of whom by his present wife is a mantuamaker in Newcastle.—His eldest son is now 83 years old, and the youngest only nine. Nor, in all probability, would this lad close the rear of his immediate progeny, if his present wife, the boy's mother, had not attained to the 49th year of her age.”—In his prime, he did not exceed five feet and seven inches. He is now inclined through age to five feet five inches. He has an interesting physiognomy expressive of sincerity, sensibility, and manly courage. His biographer very properly submits it to the consideration of the Polygraphic Society, whether they might not do a thing worthy of themselves and their ingenious art, if they should multiply likenesses of this living antiquity, and circulate them at an easy rate throughout Britain and Europe. They would thus gratify a very general curiosity; a curiosity not confined to the present age.

Longevity various means that have been considered as conducive to health and long life; and, if possible, to distinguish such circumstances as are essential to that great end from those which are merely accidental. But here it is much to be regretted, that an accurate history of the lives of all the remarkable persons in the above table, so far as relates to the diet, regimen, and the use of the non-naturals, has not been faithfully handed down to us; without which it is impossible to draw the necessary inferences. Is it not then a matter of astonishment, that historians and philosophers have hitherto paid so little attention to longevity? If the present imperfect list should excite others, of more leisure and better abilities, to undertake a full investigation of so interesting a subject, the inquiry might prove not only curious but highly useful to mankind. In order to furnish materials for a future history of longevity, the bills of mortality throughout the kingdom ought first to be revised, and put on a better footing, agreeable to the scheme of which Manchester and Chester have already given a specimen highly worthy of imitation. The plan, however, might be further improved with very little trouble, by adding a particular account of the diet and regimen of every person who dies at 80 years of age or upwards; and mentioning whether his parents were healthy, long-lived people, &c. An accurate register, thus established throughout the British dominions, would be productive of many important advantages to society, not only in a medical and philosophical, but also in a political and moral view.

All the circumstances that are most essentially necessary to life, may be compromised under the six following heads: 1. Air and climate; 2. Meat and drink; 3. Motion and rest; 4. The secretions and excretions; 5. Sleep and watching; 6. Affections of the mind.

These, though all perfectly natural to the constitution, have by writers been styled the non-naturals, by a strange perversion of language; and have been all copiously handled under that improper term. However, it may not be amiss to offer a few short observations on each, as they are so immediately connected with the present subject.

1. *Air, &c.* It has long been known that fresh air is more immediately necessary to life than food; for a man may live two or three days without the latter, but not many minutes without the former. The vivifying principle contained in the atmosphere, so essential to the support of flame, as well as animal life, concerning which authors have proposed so many conjectures, appears now to be nothing else but that pure dephlogisticated fluid lately discovered by that ingenious philosopher Dr Priestley. The common atmosphere may well be supposed to be more or less healthy in proportion as it abounds with this animating principle. As this exhales in copious streams from the green leaves of all kinds of vegetables, even from those of the most poisonous kind, may we not, in some measure, account why instances of longevity are so much more frequent in the country than in large cities; where the air, instead of partaking so largely of this salutary impregnation, is daily contaminated with noxious animal effluvia and phlogiston?

With respect to climate, various observations conspire to prove, that those regions which lie within the

temperate zones are best calculated to promote long life. Hence, perhaps, may be explained, why Italy has produced so many long lived, and why islands in general are more salutary than continents; of which Bermudas and some others afford examples. And it is a pleasing circumstance that our own island appears from the above table (notwithstanding the sudden vicissitudes to which it is liable) to contain far more instances of longevity than could well be imagined. The ingenious Mr Whitehurst assures us, from certain facts, that Englishmen are in general longer lived than North Americans; and that a British constitution will last longer, even in that climate, than a native one. But it must be allowed in general, that the human constitution is adapted to the peculiar state and temperature of each respective climate, so that no part of the habitable globe can be pronounced too hot or too cold for its inhabitants. Yet, in order to promote a friendly intercourse between the most remote regions, the Author of nature has wisely enabled the inhabitants to endure great and surprising changes of temperature with impunity.

2. *Foods and drink.* Though foods and drink of the most simple kinds are allowed to be the best calculated for supporting the body in health, yet it can hardly be doubted but variety may be safely indulged occasionally, provided men would restrain their appetites within the bounds of temperance; for bountiful Nature cannot be supposed to have poured forth such a rich profusion of provisions, merely to tantalize the human species, without attributing to her the part of a cruel step-dame, instead of that of the kind and indulgent parent. Besides, we find, that by the wonderful powers of the digestive organs, a variety of animal and vegetable substances, of very discordant principles, are happily assimilated into one bland homogeneous chyle; therefore it seems natural to distrust those cynical writers, who would rigidly confine mankind to one simple dish, and their drink to the mere water of the brook. Nature, it is true, has pointed out that mild insipid fluid as the universal diluent, and therefore most admirably adapted for our daily beverage. But experience has equally proved, that vinous and spirituous liquors, on certain occasions, are no less salutary and beneficial, whether it be to support strength against sickness or bodily fatigue, or to exhilarate the mind under the pressure of heavy misfortunes. But, alas! what Nature meant for innocent and useful cordials, to be used only occasionally, and according to the direction of reason, custom and caprice have, by degrees, rendered habitual to the human frame, and liable to the most enormous and destructive abuses. Hence it may be justly doubted, whether gluttony and intemperance have not depopulated the world more than even the sword, pestilence, and famine. True, therefore, is the old maxim, "*Modus utendi est veneno facit medicamentum, ex medicamento venenum.*"

3. and 4. *Motion and rest, sleep and watching.* It is allowed on all hands, that alternate motion and rest, and sleep and watching, are necessary conditions to health and longevity; and that they ought to be adapted to age, temperament, constitution, temperature of the climate, &c.; but the errors which mankind daily commit in these respects become a fruitful source of diseases. While some are bloated and relaxed with

Longevity
Longfoot

ease and indolence, others are emaciated, and become rigid through hard labour, watching, and fatigue

5. *Secretions and excretions.* Where the animal functions are duly performed, the secretions go on regularly; and the different evacuations so exactly correspond to the quantity of aliment taken in, in a given time, that the body is found to return daily to nearly the same weight. If any particular evacuation happen to be preternaturally diminished, some other evacuation is proportionally augmented, and the equilibrium is commonly preserved; but continued irregularities, in these important functions, cannot but terminate in disease.

6. *Affections of the mind.* The due regulation of the passions, perhaps, contributes more to health and longevity than that of any other of the non-naturals. The animating passions, such as joy, hope, love, &c. when kept within proper bounds, gently excite the nervous influence, promote an equable circulation, and are highly conducive to health; while the depressing affections, such as fear, grief, and despair, produce the contrary effect, and lay the foundation of the most formidable diseases.

From the light which history affords us, as well as from some instances in the above table, there is great reason to believe, that longevity is in a great measure hereditary; and that healthy long-lived parents would commonly transmit the same to their children, were it not for the frequent errors in the non-naturals, which so evidently tend to the abbreviation of human life.

Where is it, but from these causes, and the unnatural modes of living, that, of all the children which are born in the capital cities of Europe, nearly one half die in early infancy? To what else can we attribute this extraordinary mortality? Such an amazing proportion of premature deaths is a circumstance unheard of among savage nations, or among the young of other animals! In the earliest ages, we are informed, that human life was protracted to a very extraordinary length; yet how few persons, in these latter times, arrive at that period which nature seems to have designed! Man is by nature a field-animal, and seems destined to rise with the sun, and to spend a large portion of his time in the open air, to inure his body to robust exercises and the inclemency of the seasons, and to make a plain homely repast only when hunger dictates. But art has studiously defeated the kind intentions of nature; and by enervating him to all the blandishments of sense, has left him, alas! an easy victim to folly and caprice. To enumerate the various abuses which take place from the earliest infancy, and which are continued through the succeeding stages of modish life, would carry us far beyond our present intention. Suffice it to observe, that they prevail more particularly among people who are the most highly polished and refined. To compare their artificial mode of life with that of nature, or even with the long-livers in the lit, would probably afford a very striking contrast; and at the same time supply an additional reason why, in the very large cities, instances of longevity are so very rare.

LONGFORD, a county of Ireland, in the province of Leinster, bounded by the county of Leitrim and Caven on the north, Meath on the east and south, and Roscommon on the west. It contains 134,700

Irish plantation acres, 24 parishes, 6 baronies, and 4 boroughs; and returns 10 members to parliament. It is small, and much encumbered with bog, intermixed with a tolerable good soil; and is about 25 miles long and 15 broad.

LONGFORD, a town of Ireland, situated on the river Cromlin, in the county of Longford and province of Leinster, 64 miles from Dublin; which river falls a few miles below this place into the Shannon. It is a borough, post, market, and fair town; and returns two members to parliament; patron, Lord Longford. It gave title of earl to the family of Angier; of viscount, to the family of Micklethwaite; and now gives that of baron to the family of Packenham. Within a mile and a half of the town is a charter-school for above 40 children. This place has a barrack for a troop of horse. It is large and well built; and in a very early age an abbey was founded here, of which St Idus, one of St Patrick's disciples, was abbot. In the year 1400, a fine monastery was founded to the honour of the Virgin Mary, for Dominican friars, by O'Ferral prince of Annaly. This monastery being destroyed by fire, Pope Martin V. by a bull in the year 1429, granted an indulgence to all who should contribute to the rebuilding of it. In 1433, Pope Eugene IV. granted a bull to the same purpose; and in 1438 he granted another to the like effect. The church of this friary, now the parish-church, is in the diocese of Ardagh. The fairs are four in the year.

LONG-ISLAND, is an island of North America, belonging to the state of New-York, which is separated from the continent by a narrow channel. It extends from the city of New-York east 140 miles, terminating with Montauk point; and is not more than 10 miles in breadth on a medium. It is divided into three counties, King's, Queen's, and Suffolk. The south side of the island is flat land, of a light sandy soil, bordered on the sea-coast with large tracts of salt meadow, extending from the west point of the island to Southampton. This soil, however, is well calculated for raising grain, especially Indian corn. The north side of the island is hilly, and of a strong soil, adapted to the culture of grain, hay, and fruit. A ridge of hills extends from Jamaica to South-hold. Large herds of cattle feed upon Hempstead plain and on the salt marshes upon the south side of the island. Hempstead plain in Queen's county is a curiosity. It is 16 miles in length, east and west, and 7 or 8 miles wide. The soil is black, and to appearance rich and yet it was never known to have any natural growth, but a kind of wild grafs and a few shrubs. It is frequented by vast numbers of plover. Rye grows tolerably well on some parts of the plain. The most of it lies common for cattle, horses, and sheep. As there is nothing to impede the prospect in the whole length of this plain, it has a curious but tiresome effect upon the eye, not unlike that of the ocean. The island contains 30,863 inhabitants.

LONGIMETRY, the art of measuring lengths, both accessible and inaccessible. See GEOMETRY and TRIGONOMETRY.

LONGING, is a preternatural appetite in pregnant women, and in some sick persons when about to recover. It is called *pica*, from the bird of that name, which is said to be subject to the same disorder. The disorder

Longford
Longing.

Longinus.
Longinus.

confists of both a desire of unusual things to eat and drink, and in being soon tired of one and wanting another. It is called *malicia*, from *μαλινος*, "weakness." In pregnant women it is somewhat relieved by bleeding, and in about the fourth month of their pregnancy it leaves them. Chlorotic girls, and men who labour under suppressed hemorrhoids, are very subject to this complaint, and are relieved by promoting the respective evacuations. In general, whether this disorder is observed in pregnant women, in persons recovering from an acute fever, or in those who labour under obstructions of the natural evacuations, this craving of the appetite should be indulged.

LONGINICO, a town of Turkey in Europe, in the Morea, anciently called *Olympia*, famous for being the place where the Olympic games were celebrated, and for the temple of Jupiter Olympus, about a mile distant. It is now but a small place, seated on the river Alpheus, 10 miles from its mouth, and 50 south of Lepanto. E. Long. 22. 0. N. Lat. 37. 30.

LONGINUS (Dionysius), a celebrated Greek critic of the third century, was probably an Athenian. His father's name is unknown, but by his mother he was allied to the celebrated Plutarch. His youth was spent in travelling with his parents, which gave him an opportunity to increase his knowledge, and improve his mind. After his travels, he fixed his residence at Athens, and with the greatest assiduity applied to study. Here he published his Treatise on the Sublime; which raised his reputation to such a height, and gave the Athenians such an opinion of his judgment and taste, that they made him sovereign judge of all authors, and every thing was received and rejected by the public according to his decisions. He seems to have staid at Athens a long time; here he taught the academic philosophy, and among others had the famous Porphyry for his pupil. But it was at length his fortune to be drawn from Athens, and to mix in more active scenes; to train up young princes to virtue and glory; to guide the busy passions of the great to noble objects; to struggle for, and at last to die, in the cause of liberty. Zenobia, queen of the East, prevailed on him to undertake the education of her sons; and he soon gained an uncommon share in her esteem: she spent the vacant hours of her life in his conversation, and modelled her sentiments and conduct by his instructions. That prince was at war with Aurelian; and being defeated by him near Antioch, was compelled to shut herself up in Palmyra, her capital city. The emperor wrote her a letter, in which he ordered her to surrender; to which she returned an answer, drawn up by Longinus, which filled him with resentment. The emperor laid siege to the city; and the Palmyrians were at length obliged to open their gates and receive the conqueror. The Queen and Longinus endeavoured to fly into Persia; but were unhappily overtaken and made prisoners when they were on the point of crossing the Euphrates. The Queen, intimidated, weakly laid the blame of vindicating the liberty of her country on its true author; and the brave Longinus, to the disgrace of the conqueror, was carried away to immediate execution. The writings of Longinus were numerous, some on philosophical, but the greater part on critical subjects. Dr Pearce has collected the titles of 25 treatises, none of which, excepting that on the Sublime, have escaped

the depredations of time and barbarians. On this imperfect piece the great fame of Longinus is raised, who, as Pope expresses it—"is himself the great fublime he draws." The best edition of his works is that by Tollius, printed at Utrecht in 1694, *cum notis variorum*. It has been translated into English by Mr Smith.

LONGISSIMUS DORSI. See ANATOMY, Table of the Muscles.

LONGITUDE, in geography and navigation, is the distance of any place from another eastward or westward, counted in degrees upon the equator; but when the distance is reckoned by leagues or miles and not in degrees, or in degrees on the meridian, and not of the parallel of latitude, in which case it includes both latitude and longitude, it is called *departure*.

To find the longitude at sea, is a problem to which the attention of navigators and mathematicians has been drawn ever since navigation began to be improved.—The importance of this problem soon became well known, that, in 1598, Philip III. of Spain offered a reward of 1000 crowns for the solution; and his example was soon followed by the States General, who offered 10,000 florins. In 1714 an act was passed in the British parliament, empowering certain commissioners to make out a bill for a sum not exceeding 2000 l. for defraying the necessary expences of experiments for ascertaining this point; and likewise granting a reward to the person who made any progress in the solution, proportionable to the degree of accuracy with which the solution was performed: 10,000 l. was granted if the longitude should be determined to one degree of a great circle, or 60 geographical miles; 15,000 if to two thirds of that distance; and 20,000 if to the half the distance.

In consequence of these proffered rewards, innumerable attempts were made to discover this important secret. The first was that of John Morin professor of mathematics at Paris, who proposed it to Cardinal Richelieu; and though it was judged insufficient on account of the imperfection of the lunar tables, a pension of 2000 livres *per annum* was procured for him in 1645 by Cardinal Mazarine. Gemma Frisius had indeed, in 1530, projected a method of finding the longitude by means of watches, which at that time were newly invented: but the structure of these machines was then by far too imperfect to admit of any attempt; nor even in 1631, when Metius made an attempt to this purpose, were they advanced in any considerable degree. About the year 1664, Dr Hooke and Mr Huygens made a very great improvement in watchmaking, by the application of the pendulum spring. Dr Hooke having quarrelled with the ministry, no experiment was made with any of his machines; but many were made with those of Mr Huygens. One experiment, particularly, made by Major Holmes, in a voyage from the Coast of Guinea in 1665, answered so well, that Mr Huygens was encouraged to improve the structure of his watches; but it was found that the variations of heat and cold produced such alterations in the rate of going of the watch, that unless this could be remedied, the watches could be of little use in determining the longitude.

In 1714 Henry Sully, an Englishman, printed a small tract at Vienna upon the subject of watchmaking.

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making. Having afterwards removed to Paris, he applied himself to the improvement of time-keepers for the discovery of the longitude. He taught the famous Julian de Roy; and this gentleman, with his son, and M. Berthoud, are the only persons who, since the days of Sully, have turned their thoughts this way. But though experiments have been made at sea with some of their watches, it does not appear that they have been able to accomplish any thing of importance with regard to the main point. The first who succeeded in any considerable degree was Mr John Harrison; who, in 1726, produced a watch which went so exactly, that for ten years together it did not err above one second in a month. In 1736 it was tried in a voyage to Lisbon and back again, on board one of his Majesty's ships; during which it corrected an error of a degree and an half in the computation of the ship's reckoning. In consequence of this he received public encouragement to go on; and by the year 1761 had finished three time-keepers, each of them more accurate than the former. The last turned out so much to his satisfaction, that he now applied to the commissioners of longitude for leave to make an experiment with his watch in a voyage to the West Indies. Permission being granted, his son Mr William Harrison set out in his Majesty's ship the *Deptford* for Jamaica in the month of November 1761. This trial was attended with all imaginable success. The longitude of the island, as determined by the time-keeper, differed from that found by astronomical observations only one minute and a quarter of the equator; the longitudes of places seen by the way being also determined with great exactness. On the ship's return to England, it was found to have erred no more during the whole voyage than $1^{\circ} 54\frac{1}{2}'$ in time, which is little more than 28 miles in distance; which being within the limits prescribed by the act, the inventor claimed the whole £.20,000 offered by government. Objections to this, however, were soon started. Doubts were pretended about the real longitude of Jamaica, as well as the manner in which the time had been found both there and at Portsmouth. It was alleged also, that although the time-keeper happened to be right at Jamaica, and after its return to England, this was by no means a proof that it had always been so in the intermediate times; in consequence of which allegations, another trial was appointed in a voyage to Barbadoes. Precautions were now taken to obviate as many of these objections as possible. The commissioners sent out proper persons to make astronomical observations at that island; which, when compared with others in England, would ascertain beyond a doubt its true situation. In 1764 then, Mr Harrison junior set sail for Barbadoes; and the result of the experiment was, that the difference of longitude betwixt Portsmouth and Barbadoes was shown by the time-keeper to be $3^{\text{h}}. 55^{\text{m}}. 3^{\text{s}}$; and by astronomical observations to be $3^{\text{h}}. 54^{\text{m}}. 20^{\text{s}}$; the error being now only $43''$ of time, or $10^{\circ} 45'$ of longitude. In consequence of this and the former trials, Mr Harrison received one half of the reward promised, upon making a discovery of the principles upon which his time-keepers were constructed. He was likewise promised the other half of the reward as soon as time-keepers should be constructed by other artists which should answer the purpose as

well as those of Mr Harrison himself. At this time he delivered up all his time-keepers, the last of which was sent to Greenwich to be tried by Mr Nevil Maskelyne the astronomer-royal. On trial, however, it was found to go with much less regularity than had been expected; but Mr Harrison attributed this to his having made some experiments with it which he had not time to finish when he was ordered to deliver up the watch. Soon after this, an agreement was made by the commissioners with Mr Kendall to construct a watch upon Mr Harrison's principles; and this upon trial was found to answer the purpose even better than any that Harrison himself had constructed. This watch was sent out with Captain Cook in 1772; and during all the time of his voyage round the world in 1772, 1773, 1774, and 1775, never erred quite $14\frac{1}{2}$ seconds per day: in consequence of which, the house of commons, in 1774, ordered the other £.10,000 to be paid to Mr Harrison. Still greater accuracy, however, has been attained. A watch was lately constructed by Mr Arnold, which, during a trial of 13 months, from February 1779 to February 1780, varied no more than 6.69 during any two days; and the greatest difference between its rates of going on any day and the next to it was .11." The greatest error it would have committed therefore in the longitude during any single day would have been very little more than one minute of longitude; and thus might the longitude be determined with as great exactness as the latitude generally can.—This watch, however, has not yet been tried at sea.

Thus the method of constructing time-keepers for discovering the longitude seems to be brought to as great a degree of perfection as can well be expected. Still, however, as these watches are subject to accidents, and may thus alter the rate of their going without any possibility of a discovery, it is necessary that some other method should be fallen upon, in order to correct from time to time those errors which may arise either from the natural going of the watch, or from any accident which may happen to it. Methods of this kind are all founded upon celestial observations of some kind or other; and for these methods, or even for an improvement in time-keepers, rewards are still held out by government. After the discoveries made by Mr Harrison, the act concerning the longitude was repealed, excepting so much of it as related to the constructing, printing, publishing, &c. of nautical almanacks and other useful tables. It was enacted also, that any person who shall discover a method for finding the longitude by means of a time-keeper, the principles of which have not hitherto been made public, shall be intitled to a reward of £.5000, if, after certain trials made by the commissioners, the said method shall enable a ship to keep her longitude during a voyage of six months within 60 geographical miles or a degree of a great circle. If the ship keeps her longitude within 40 geographical miles for that time, the inventor is intitled to a reward of £.7500, and to £.10,000 if the longitude is kept within half a degree. If the method is by improved astronomical tables, the author is intitled to £.5000 when they show the distance of the moon from the sun and stars within 15 seconds of a degree, answering to about 7 minutes of longitude, after allowing half a degree for errors

Longitude. errors of observation, and under certain restrictions, and after comparison with astronomical observations for a period of $18\frac{1}{2}$ years, during which the lunar irregularities are supposed to be completed. The same rewards are offered to the person who shall with the like accuracy discover any other method of finding the longitude.

These methods require celestial observations; and any of the phenomena, such as the different apparent places of stars with regard to the moon, the beginning and ending of eclipses, &c. will answer the purpose: only it is absolutely necessary that some variation should be perceptible in the phenomenon in the space of two minutes; for even this short space of time will produce an error of 30 miles in longitude. The most proper phenomena therefore for determining the longitude in this manner are the eclipses of Jupiter's satellites. Tables of their motions have been constructed, and carefully corrected from time to time, as the mutual attractions of these bodies are found greatly to disturb the regularity of their motions. The difficulty here, however, is to observe these eclipses at sea; and this difficulty has been found so great, that no person seems able to surmount it. The difficulty arises from the violent agitation of a ship in the ocean, for which no adequate remedy has ever yet been found, nor probably will ever be found. Mr Christopher Irwin indeed invented a machine which he called a *marine chair*, with a view to prevent the effects of this agitation; but on trying it in a voyage to Barbadoes, it was found to be totally useless.

A whimsical method of finding the longitude was proposed by Messrs Whiston and Ditton from the report and flash of great guns. The motion of sound is known to be nearly equal, from whatever body it proceeds or whatever be the medium. Supposing therefore a mortar to be fired at any place the longitude of which is known, the difference between the moment that the flash is seen and the report heard will give the distance between the two places; whence, if we know the latitudes of these places, their longitudes must also be known. If the exact time of the explosion be known at the place where it happens, the difference of time at the place where it is heard will likewise give the difference of longitude. Let us next suppose the mortar to be loaded with an iron shell filled with combustible matter, and fired perpendicularly upward into the air, the shell will be carried to the height of a mile, and will be seen at the distance of near 100; whence, supposing neither the flash of the mortar should be seen nor the report heard, still the longitude might be determined by the altitude of the shell above the horizon.

According to this plan, mortars were to be fired at certain times and at proper stations along all frequented coasts for the direction of mariners. This indeed might be of use, and in stormy weather might be a kind of improvement in light-houses, or a proper addition to them; but with regard to the determination of longitudes, is evidently ridiculous.

We shall now proceed to give some practical directions for finding the longitude at sea by proper celestial observations; exclusive of those from Jupiter's satellites, which, for reasons just mentioned, cannot be practised at sea. In the first place, however, it will be

Longitude. necessary to point out some of those difficulties which stand in the way, and which render even this method of finding the longitude precarious and uncertain. These lie principally in the reduction of the observations of the heavenly bodies made on the surface of the earth to similar observations supposed to be made at the centre; which is the only place where the celestial bodies appear in their proper situation. It is also very difficult to make proper allowances for the refraction of the atmosphere, by which all objects appear higher than they really are; and another difficulty arises from their parallaxes, which makes them, particularly the moon, appear lower than they would otherwise do, excepting when they are in the very zenith. It is also well known, that the nearer the horizon any celestial body is, the greater its parallax will be; and as the parallax and refraction act in opposite ways to one another, the former depressing and the latter raising the object, it is plain, that great difficulties must arise from this circumstance. The sun, for instance, whose parallax is less than the refraction, must always appear higher than he really is; but the moon, whose parallax is greater than her refraction, must always appear lower.

To render observations of the celestial bodies more easy, the commissioners of longitude have caused an Ephemeris or Nautical Almanack to be published annually, containing every requisite for solving this important problem which can be put into the form of tables. But whatever may be done in this way, it will be necessary to make the necessary preparations concerning the dip of the horizon, the refraction, semi-diameters, parallax, &c. in order to reduce the apparent to the true altitudes and distances; for which we shall here subjoin two general rules.

The principal observation for finding the longitude at sea is that of the moon from the sun, or from some remarkable star near the zodiac. To do this, the operator must be furnished with a watch which can be depended upon for keeping time within a minute for six hours; and with a good Hadley's quadrant, or, which is preferable, a sextant; and this last instrument will still be more fit for the purpose if it be furnished with a screw for moving the index gradually; likewise an additional dark glass, but not so dark as the common kind, for taking off the glare of the moon's light in observing her distance from a star. A small telescope, which may magnify three or four times, is also necessary to render the contact of a star with the moon's limb more discernible. A magnifying glass of $1\frac{1}{2}$ or 2 inches focus will likewise assist the operator in reading off his observations with the greater facility.

1. *To make the observation.* Having examined and adjusted his instrument as well as possible, the observer is next to proceed in the following manner: If the distance of the moon from the sun is to be observed, turn down one of the screens; look at the moon directly through the transparent part of the horizon-glass; and keeping her in view, gently move the index till the sun's image be brought into the silvered part of that glass. Bring the nearest limbs of both objects into contact, and let the quadrant librate a little on the lunar ray; by which means the sun will appear to rise and fall by the side of the moon; in which motion the nearest limbs must be made to touch one another exactly by moving the index. The ob-

Longitude. servation is then made; and the division coinciding with that on the Vernier scale, will show the distance of the nearest limbs of the objects.

When the distance of the moon from a star is to be observed when the moon is very bright, turn down the lightest screen, or use a dark glass lighter than the screens, and designed for this particular purpose; look at the star directly through the transparent part of the horizon-glass; and keeping it there, move the index till the moon's image is brought into the silvered part of the same glass. Make the quadrant librate gently on the star's ray, and the moon will appear to rise and fall by the star: move the index between the librations, until the moon's enlightened limb is exactly touched by the star, and then the observation is made. In these operations, the plane of the quadrant must always pass through the two objects, the distance of which is to be observed; and for this purpose it must be placed in various positions according to the situation of the objects, which will soon be rendered easy by practice.

The observation being made, somebody at the very instant that the operator calls must observe by the watch the exact hour, minute, and quarter minute, if there be no second hand, in order to find the apparent time; and at the same instant, or as quick as possible, two assistants must take the altitudes of those objects the distance of which is observed; after which, the observations necessary for finding the longitude are completed.

The ephemeris shows the moon's distance from the sun, and likewise from proper stars, to every three hours of apparent time for the meridian of Greenwich; and that the greater number of opportunities of observing this luminary may be given, her distance is generally set down from at least one object on each side of her. Her distance from the sun is set down while it is between 40 and 120 degrees; so that, by means of a sextant, it may be observed for two or three days after her first and before her last quarter. When the moon is between 40 and 90 degrees from the sun, her distance is set down both from the sun and from a star on the contrary side; and, lastly, when the distance is above 120 degrees, the distance is set down from two stars, one on each side of her. The distance of the moon from objects on the east side of her is found in the ephemeris in the 8th and 9th pages of the month; and her distance from objects on the west is found in the 10th and 11th pages of the month.

When the ephemeris is used, the distance of the moon must only be observed from those stars the distance of which is set down there; and these afford a ready means of knowing the star from which her distance ought to be observed. The observer has then nothing more to do than to set his index to the distance roughly computed at the apparent time, estimated nearly for the meridian at Greenwich; after which he is to look to the east or west of the moon, according as the distance of the star is found in the 8th or 9th, or in the 10th or 11th, pages of the month; and having found the moon upon the horizon-glass, the star will easily be found by sweeping with the quadrant to the right or left, provided the air be clear and the star be in the line of the moon's shortest axis produced. The time at Greenwich is estimated by turning into time the supposed longitude

from that place, and adding it to the apparent time at *Longitude.* the ship, or subtracting it from it as occasion requires. The distance of the moon from the sun, or a star, is roughly found at this time, by saying, As 180 minutes (the number contained in three hours) is to the difference in minutes between this nearly estimated time and the next preceding time set down in the ephemeris; so is the difference in minutes between the distances in the ephemeris for the next preceding and next following times, to a number of minutes; which being added to the next preceding distance, or subtracted from it, according as it is increasing or decreasing, will give the distance nearly at the time the observation is to be made, and to which the index must be set.

An easier method of finding the angular distance is by bringing the objects nearly into contact in the common way, and then fixing the index tight to a certain degree and minute; waiting until the objects are nearly in contact, giving notice to the assistants to get ready with the altitudes, and when the objects are exactly in contact to call for the altitudes and the exact time by the watch. The observer may then prepare for taking another distance, by setting his index three or four minutes backwards or forwards, as the objects happen to be receding from or approaching to each other; thus proceeding to take the distance, altitudes, and time by the watch, as before. Thus the observer may take as many distances as he thinks proper; but four at the distance of three minutes, or three at the distance of four minutes, will at all times be sufficient. Thus not only the eye of the observer will be less fatigued, but he will likewise be enabled to manage his instrument with much greater facility in every direction, a vertical one only excepted. If in taking the distances the middle one can be taken at any even division on the arch, such as a degree, or a degree and 20 or 40 minutes, that distance will be independent of the Nonius division, and consequently free of those errors which frequently arise from the inequality of that division in several parts of the graduated arch. The observation ought always to be made about two hours before or after noon; and the true time may be found by the altitude of the sun taken at the precise time of the distance. If three distances are taken, then find the time by the altitude corresponding with the middle distance; and thus the observation will be secured from any error arising from the irregularity of the going of the watch. As the time, however, found by the altitude of a star cannot be depended upon, because of the uncertainty of the horizon in the night, the best way of determining the time for a night observation will be by two altitudes of the sun; one taken on the preceding afternoon, before he is within six degrees of the horizon; and the other on the next morning, when he is more than six degrees high. It must be observed, however, that in order to follow these directions, it is necessary that the atmosphere should be pretty free from clouds; otherwise the observer must take the observations at such times as he can best obtain them.

2. To reduce the observed Distance of the Sun or a Star from the moon to the true Distance. 1. Turn the longitude into time, and add it to the time at the ship if the longitude be west, but subtract it if it be east, which

which will give the supposed time at Greenwich; and this we may call *reduced time*. 2. Find the nearest noon or midnight both before and after the reduced time in the seventh page of the month in the ephemeris. 3. Take out the moon's semidiameter and horizontal parallaxes corresponding to these noons and midnights, and find their differences. Then say, As 12 hours is to the moon's semidiameter in 12 hours, so is the reduced time to a number of seconds; which, either added to or subtracted from the moon's semidiameter at the noon or midnight just mentioned, according as it is increasing or decreasing, will give her apparent semidiameter; to which add the correction from Table VIII. of the ephemeris, and the sum will be her true semidiameter at the reduced time. And as 12 hours is to the difference of the moon's horizontal parallax in 12 hours, so is the reduced time to a fourth number; which, being added to or subtracted from the moon's horizontal parallax at the noon or midnight before the reduced time, according as it is increasing or decreasing, the sum or difference will be the moon's horizontal parallax at the reduced time. 4. If the reduced time be nearly any even part of 12 hours, viz $\frac{1}{2}$ th, $\frac{1}{4}$ th, &c. these parts of the difference may be taken, and either added or subtracted according to the directions already given, without being at the trouble of working by the rule of proportion. 5. To the observed altitude of the sun's lower limb add the difference betwixt his semidiameter and dip; and that sum will be his apparent altitude. 6. From the sun's refraction take his parallax in altitude, and the remainder will be the correction of the sun's altitude. 7. From the star's observed altitude take the dip of the horizon, and the remainder will be the apparent altitude. 8. The refraction of a star will be the correction of its altitude. 9. Take the difference between the moon's semidiameter and dip, and add it to the observed altitude if her lower limb was taken, or subtract it if her upper limb was taken; and the sum or difference will be the apparent altitude of her centre. 10. From the proportional logarithm of the moon's horizontal parallax, taken out of the nautical almanack (increasing its index by 10), take the logarithmic cosine of the moon's apparent altitude, the remainder will be the proportional logarithm of her parallax in altitude; from which take her refraction, and the remainder will be the correction of the moon's altitude. 11. To the observed distance of the moon from a star add her semidiameter if the nearest limb be taken, but subtract it if the farthest limb was taken, and the sum or difference will be the apparent distance. 12. To the observed distance of the sun and moon add both their semidiameters, and the sum will be the apparent distance of their centres.

3. To find the true Distance of the Objects, having their apparent Altitudes and Distances. 1. To the proportional logarithm of the correction of the sun or star's altitude, add the logarithmic cosine of the sun or star's apparent altitude; the logarithmic sine of the apparent distance of the moon from the sun or star; and the logarithmic co-secant of the moon's apparent altitude. The sum of these, rejecting 30 from the index, will be the proportional logarithm of the first angle. 2. To the proportional logarithm of the correction of the sun or star's altitude, add the loga-

rithmic co-tangent of the sun or star's apparent altitude, and the logarithmic tangent of the apparent distance of the moon from the sun or star. The sum of these, rejecting 20 in the index, will be the proportional logarithm of the second angle. 3. Take the difference between the first and second angles, adding it to the apparent distance if it be less than 90, and the first angle be greater than the second; but subtracting it if the second be greater than the first. If the distance be greater than 90, the sum of the angles must be added to the apparent distance, which will give the distance corrected for the refraction of the sun or star. 4. To the proportional logarithm of the correction of the moon's altitude add the logarithmic cosine of her apparent altitude; and the logarithmic sine of the distance corrected for the sun or star's refraction, and the logarithmic co-secant of the sun or star's apparent altitude. The sum, rejecting 30 in the index, will be the proportional logarithm of the third angle. 5. To the proportional logarithm of the correction of the moon's apparent altitude, add the logarithmic co-tangent of her apparent altitude, and the tangent of the distance corrected for the sun or star's refraction; their sum, rejecting 20 in the index, will be the proportional logarithm of the fourth angle. 6. Take the difference between the third and fourth angles, and subtract it from the distance corrected for the sun or star's refraction if less than 90, and the third angle be greater than the fourth; or add it to the distance if the fourth angle be greater than the third; but if the distance be more than 90, the sum of the angles must be subtracted from it, to give the distance corrected for the sun or star's refraction, and the principal effects of the moon's parallax. 7. In Table XX. of the ephemeris, look for the distance corrected for the sun and star's refraction, and the moon's parallax in the top column, and the correction of her altitude in the left-hand side column; take out the number of seconds that stand under the former, and opposite to the latter. Look again in the same table for the corrected distance in the top column, and the correction of the moon's altitude in the left-hand side column; take out the number of seconds that stand under the former and opposite to the latter. Look again in the same table for the corrected distance in the top column, and the principal effects of the moon's parallax in the left-hand side column, and take out the number of seconds. The difference between these two numbers must be added to the corrected distance if less than 90, but subtracted from it if greater; and the sum or difference will be the true distance.

4. To determine the Longitude after having obtained the true Distance. Look in the ephemeris among the distances of the objects for the computed distance betwixt the moon and the other object observed on the given day. If it be found there, the time at Greenwich will be at the top of the column; but if it falls between two distances in the ephemeris which stand immediately before and after it, and also the difference between the distance standing before and

Longitude the computed distance; then take the proportional logarithms of the first and second differences, and the difference between these two logarithms will be the proportional logarithm of a number of hours, minutes, and seconds; which being added to the time standing over the first distance, will give the true time at Greenwich. Or it may be found by saying, As the first difference is to three hours, so is the second difference to a proportional part of time; which being added as above directed, will give the time at Greenwich. The difference between Greenwich time and that at the ship, turned into longitude, will be that at the time the observations were made; and will be east if the time at the ship is greater, but west if it is less.

Having given these general directions, we shall next proceed to show some particular examples of finding the longitude at sea by all the different methods in which it is usually tried.

1. *To find the Longitude by Computation from the Ship's Course.*—Were it possible to keep an accurate account of the distance the ship has run, and to measure it exactly by the log [†] or any other means, then both latitude and longitude would easily be found by settling the ship's account to that time. For the course and distance being known, the difference of latitude and departure is readily found by the Traverse Table; and the difference of longitude being known, the true longitude and latitude will also be known. A variety of causes, however, concur to render this computation inaccurate; particularly the ship's continual deflection from the course set by her playing to the right and left round her centre of gravity; the unequal care of those at the helm, and the distance supposed to be sailed being erroneous, on account of stormy seas, unsteady winds, currents, &c. for which it seems impossible to make any allowance. The place of the ship, however, is judged of by finding the latitude every day, if possible, by observations; and if the latitude found by observation agrees with that by the reckoning, it is presumed that the ship's place is properly determined; but if they disagree, it is concluded that the account of the longitude stands in need of correction, as the latitude by observation is always to be depended upon.

Currents very often occasion errors in the computation of a ship's place. The causes of these in the great depths of the ocean are not well known, though many of the motions near the shore can be accounted for. It is supposed that some of those in the great oceans are owing to the tide following the moon, and a certain libration of the waters arising from thence; likewise that the unsettled nature of these currents may be owing to the changes in the moon's declination. In the torrid zone, however, a considerable current is occasioned by the trade-winds, the motion being constantly to the west, at the rate of eight or ten miles per day. At the extremities of the trade-winds or near the 30th degree of north or south latitude, the currents are probably compounded of this motion to the westward, and of one towards the equator; whence all ships sailing within these limits ought to allow a course each day for the current.

When the error is supposed to have been occasioned by a current, it ought if possible to be tried whether the case is so or not; or we must make a reasonable

estimate of its drift and course. Then with the setting and drift, as a course and distance, find the difference of latitude and departure; with which the dead reckoning is to be increased or diminished: and if the latitude thus corrected agrees with that by observation, the departure thus corrected may be safely taken as true, and thus the ship's place with regard to the longitude determined.

EXAM. Suppose a ship in 24 hours finds, by her dead reckoning, that she has made 96 miles of difference of latitude north and 38 miles of departure west; but by observation finds her difference of latitude 112, and on trial that there is a current which in 24 hours makes a difference of 16 miles latitude north and 10 miles of departure east: Required the ship's departure.

	miles.	Departure by } miles.
Diff. lat. by account	96 N.	account } 38 W.
Diff. lat. by current	16 N.	current } 10
True diff. lat.	112	28 W.

Here the dead reckoning corrected by the current gives the difference of latitude 112 miles, which is the same as that found by observation; whence the departure 28 is taken as the true one.

When the error is supposed to arise from the courses and distances, we must observe, that if the difference of latitude is much more than the departure, or the direct course has been within three points of the meridian, the error is most probably in the distance. But if the departure be much greater than the difference of latitude, or the direct course be within three points of the parallel, or more than five points from the meridian, the error is probably to be ascribed to the course. But if the courses in general are near the middle of the quadrant, the error may be either in the course, or in the distance, or both. This method admits of three cases.

1. When, by the dead reckoning, the difference of latitude is more than once and an half the departure; or when the course is less than three points: Find the course to the difference of latitude and departure. With this course and the meridional difference of latitude by observation, find the difference of longitude.

2. When the dead reckoning is more than once and an half the difference of latitude; or when the course is more than five points: Find the course and distance with the difference of latitude by observation, and departure by account; then with the co-middle latitude by observation, and departure by account, find the difference of longitude.

3. When the difference of latitude and departure by account is nearly equal, or the direct course is between three and five points of the meridian: Find the course with the difference of latitude and departure by account since the last observation. With this course and the difference of latitude by observation find another departure. Take half the sum of these departures for the true one. With the true departure and difference of latitude by observation, find the true course; then with the true course and meridional difference of latitude find the difference of longitude.

2. *To find the Longitude at Sea by a Variation-chart.*—

Longitude. Dr Halley having collected a great number of observations on the variation of the needle in many parts of the world; by that means was enabled to draw certain lines on Mercator's chart, showing the variation in all the places over which they passed in the year 1700, at which time he first published the chart; whence the longitude of those places might be found by the chart provided its latitude and variation was given. The rule is, Draw a parallel of latitude on the chart through the latitude found by observation; and the point where it cuts the curved line marked with the variation that was observed will be the ship's place.

EXAM. A ship finds by observation the latitude to be $18^{\circ} 20'$ north; and the variation of the compass to be 4° west. Required the ship's place.—Lay a ruler over $18^{\circ} 20'$ north parallel to the equator; and the point where its edge cuts the curve of 4° west variation gives the ship's place, which will be found in about $27^{\circ} 10'$ west from London.

This method of finding the longitude, however, is attended with two inconveniences. 1. That when the variation lines run east or west, or nearly so, it cannot be applied; though as this happens only in certain parts of the world, a variationⁿ chart may be of great use for the rest. Even in those places indeed where the variation curves do run east or west, they may be of considerable use in correcting the latitude when meridian observations cannot be had; which frequently happens on the northern coasts of America, the Western Ocean, and about Newfoundland; for if the variation can be found exactly, the east and west curve answering to it will show the latitude. But, 2. The variation itself is subject to continual change; whence a chart, though ever so perfect at first, must in time become totally useless; and hence the charts constructed by Dr Halley, though of great utility at their first publication, became at length almost entirely useless. A new one was published in 1746 by Messrs Mountaine and Dodson, which was so well received, that in 1756 they again drew variation lines for that year, and published a third chart the year following. They also presented to the Royal Society a curious paper concerning the variation of the magnetic needle, with a set of tables annexed, containing the result of more than 50,000 observations, in six periodical reviews from the year 1700 to 1756 inclusive, adapted to every five degrees of latitude and longitude in the more frequented oceans; all of which were published in the Philosophical Transactions for 1757.

3. *To find the Longitude by the Sun's Declination.*—Having made such observations on the sun as may enable us to find his declination at the place, take the difference between this computed declination and that shown at London by the ephemeris; from which take also the daily difference of declination at that time; then say, as the daily difference of declination is to the above found difference, so is 360 degrees to the difference of longitude. In this method, however, a small error in the declination will make a great one in longitude.

4. *To find the Longitude by the Moon's culminating.*—Seek in the ephemeris for the time of her coming to the meridian on the given day and on the day following; and take their difference; also take the difference betwixt the times of culminating on the same

day as found in the ephemeris, and as observed; then say, as the daily difference in the ephemeris is to the difference between the ephemeris and observation; so is 360 degrees to the difference of longitude. In this method also a small difference in the culmination will occasion a great one in the longitude.

5. *By Eclipses of the Moon.*—This is done much in the same manner as by the eclipses of Jupiter's satellites: For if, in two or more distant places where an eclipse of the moon is visible, we carefully observe the times of the beginning and ending, the number of digits eclipsed, or the time when the shadow touches some remarkable spot, or when it leaves any particular spot on the moon, the difference of the times when the observations were made will give the difference of longitude. Phenomena of this kind, however, occur too seldom to be of much use.

6. In the 76th volume of the Philosophical Transactions, Mr Edward Pigot gives a very particular account of his method of determining the longitude and latitude of York; in which he also recommends the method of determining the longitude of places by observations of the moon's transit over the meridian. The instruments used in his observations were a gridiron pendulum-clock, a two feet and an half reflector, an eighteen inch quadrant made by Mr Bird, and a transit instrument made by Mr Sisson.

By these instruments an observation was made, on the 10th of September 1783, of the occultation of a star of the ninth magnitude by the moon, during an eclipse of that planet, at York and Paris. Besides this, there were observations made of the immerfions of ν Aquarii and δ Piscium; the result of all which was, that between Greenwich and York the difference of meridians was $4^{\circ} 27'$.

In 1783, Mr Pigot informs us, that he thought of finding the difference of meridians by observing the meridian right ascensions of the moon's limb. This he thought had been quite original; but he found it afterwards in the Nautical Almanack for 1769, and in 1784 read a pamphlet on the same subject by the Abbé Toaldo; but still found that the great exactness of this method was not suspected; though he is convinced that it must soon be universally adopted in preference to that from the first satellite of Jupiter.

After giving a number of observations on the satellites of Jupiter, he concludes, that the exactness expected from observations, even on the first satellite, is much over-rated. "Among the various objections (says he), there is one I have often experienced, and which proceeds solely from the disposition of the eye, that of seeing more distinctly at one time than another. It may not be improper also to mention, that the observation I should have relied on as the best, that of Aug. 30. 1785, marked *excellent*, is one of those most distant from the truth."

After giving a number of observations on the eclipse of the moon Sept. 10. 1783, our author concludes, that the eclipses of the moon's spots are in general too much neglected, and that it might be relied upon much more were the following circumstances attended to: 1. To be particular in specifying the clearness of the sky. 2. To choose such spots as are well defined, and leave no hesitation as to the part eclipsed. 3. That every observer should use, as far as possible, telescopes equally

Longitude. equally powerful, or at least let the magnifying powers be the same. "A principal objection (says he) may still be urged, viz. the difficulty of distinguishing the true shadow from the penumbra. Was this obviated, I believe the results would be more exact than from Jupiter's first satellite: Undoubtedly the shadow appears better defined if magnified little; but I am much inclined to think, that, with high magnifying powers, there is greater certainty of choosing the same part of the shadow, which perhaps is more than a sufficient compensation for the loss of distinctness."

The following rule for meridian observations of the moon's limb is next laid down: "The increase of the moon's right ascension in twelve hours (or any given time found by computation), is to 12 hours as the increase of the moon's right ascension between two places found by observation is to the difference of meridians.

Example.

Nov. 30, 1782.

h. ' "			
13 12 57.62	Meridian transit of moon's	} By clock at Green- wich.	
	second limb		
13 13 29.08	Ditto of α Υ		
31.46	Difference of right ascension.		
13 14 8.05	Meridian transit of moon's	} By clock at York.	
	second limb		
13 14 30.13	Ditto of α Υ		
22.08	Difference at York.	} The clocks going nearly federal time, no cor- rection is re- quired.	
31.46	Difference at Greenwich.		
9.33	Increase of the moon's ap- parent right ascension be- tween Greenwich and York, by observation.		

141' in seconds of a degree, ditto, ditto.

The increase of the moon's right ascension for 12 hours, by computation, is 23,340 seconds; and 12 hours reduced into seconds is 43,200. Therefore, according to the rule stated above,

$23,340' : 43,200' : \text{diff. of merid.} = 261''$.

"These easy observations and short reduction (says Mr Pigott) are the whole of the business. Instead of computing the moon's right ascension for 12 hours, I have constantly taken it from the Nautical Almanacks, which give it sufficiently exact, provided some attention be paid to the increase or decrease of the moon's motion. Were the following circumstances attended to, the results would be undoubtedly much more exact.

"1. Compare the observations with the same made in several other places. 2. Let several and the same stars be observed at these places. 3. Such stars as are nearest in right ascension and declination to the moon are infinitely preferable. 4. It cannot be too strongly urged to get, as near as possible, an equal number of observations of each limb, to take a mean of each set, and then a mean of both means. This will in a great measure correct the error of telescopes and sight. 5. The adjustment of the telescopes to the eye of the observer before the observation is also very necessary,

as the sight is subject to vary. 6. A principal error proceeds from the observation of the moon's limb, which may be considerably lessened, if certain little round spots near each limb were also observed in settled observatories; in which case the libration of the moon will perhaps be a consideration. 7. When the difference of meridians, or of the latitudes of places, is very considerable, the change of the moon's diameter becomes an equation.

"Though such are the requisites to use this method with advantage, only one or two of them have been employed in the observations that I have reduced. Two-thirds of these observations had not even the same stars observed at Greenwich and York; and yet none of the results, except a doubtful one, differ 15' from the mean; therefore I think we may expect a still greater exactness, perhaps within 10' if the above particulars be attended to.

"When the same stars are not observed, it is necessary for the observers at both places to compute their right ascension from tables, in order to get the apparent right of ascension of the moon's limb. Though this is not so satisfactory as by actual observation, still the difference will be trifling, provided the star's right ascensions are accurately settled. I am also of opinion, that the same method can be put in practice by travellers with little trouble, and a transit instrument, constructed so as to fix up with facility in any place. It is not necessary, perhaps, that the instrument should be perfectly in the meridian for a few seconds of time, provided stars, nearly in the same parallel of declination with the moon, are observed; nay, I am inclined to think, that if the instrument deviates even a quarter or half a degree, or more, sufficient exactness can be attained; as a table might be computed, showing the moon's parallax and motion for such deviation; which last may easily be found by the well known method of observing stars whose difference of declination is considerable.

"As travellers very seldom meet with situations to observe stars near the pole, or find a proper object for determining the error of the line of collimation, I shall recommend the following method as original.—Having computed the apparent right ascension of four, six, or more stars, which have nearly the same parallel of declination, observe half of them with the instrument inverted, and the other half when in its right position. If the difference of right ascensions between each set by observation agrees with the computation, there is no error; but if they disagree, half that disagreement is the error of the line of collimation. The same observations may also serve to determine, whether the distance of the corresponding wires are equal. In case of necessity, each limb of the sun might be observed in the same manner, though probably with less precision. By a single trial I made above two years ago, the result was much more exact than I expected. Mayor's catalogue of stars will prove of great use to those that adopt the above method.—I am rather surprised that the immersions of known stars of the sixth and seventh magnitude, behind the dark limb of the moon, are not constantly observed in fixed observatories, as they would frequently be of great use."

Longitude. The annexed rule for finding the ship's place, with the miscellaneous observations on different methods, we have been favoured with by Mr John M'Lean of the Observatory, Edinburgh. The rule was examined and approved of by Sir Joseph Banks president of the Royal Society.

1. With regard to determining the ship's place by the help of the course and distance sailed, the following rule may be applied.—It will be found as expeditious as any of the common methods by the middle latitude or meridional parts; and is in some respects preferable, as the common tables of sines and tangents only are requisite in applying it.—Let a and b be the distances of two places from the same pole in degrees, or their complete latitudes; c the angle which a meridian makes with the rhumb line passing through the places; and L the angle formed by their meridians, or the difference of longitude in minutes: then A and B being the logarithmic tangents of $\frac{1}{2}a$ and $\frac{1}{2}b$, S the sine of C , and S the sine of $(C+1)$, we shall have the following equation $L = \frac{A+B}{S-S'} (A)$. Also, from a well known property of the rhumb line, we have the following equation:

$S+E=R+D$, where S is the logarithmic cosine of C , E the logarithm of the length of the rhumb-line, or distance, D the logarithm of the minute's difference of latitude, and R the logarithm of the radius.

By the help of these two equations, we shall have an easy solution of the several cases to which the middle latitude, or meridional parts, are commonly applied.

Example. A ship from a port, in latitude 56° N. sails SW. by W. till she arrives at the latitude of 40° N: Required the difference of longitude.

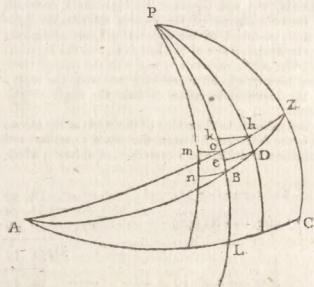
Here $a=34^{\circ}$, $b=50^{\circ}$, $c=56^{\circ}15'$, $A=9.48534$, $B=9.56107$, $S=9.199308$, $S'=9.198464$; therefore, $L = \frac{A+B}{S-S'} = \frac{757300}{844} = 897$ the minutes difference of longitude. Also, $S=9.74474$, $D=2.98227$; therefore $E=R+D-S=3.23753$, to which the natural number is 1728, the miles in the rhumb-line sailed over.

2. The common method of finding the difference of longitude made good upon several courses and distances, by means of the difference of latitude and departure made good upon the several courses, is not accurately true.

For example: If a ship should sail due south 600 miles, from a port in 60° north latitude, and then due west 600 miles, the difference of longitude found by the common methods of solution would be 1053; whereas the true difference of longitude is only 933, less than the former by 120 miles, which is more than $\frac{1}{5}$ of the whole. Indeed every considerable alteration in the course will produce a very sensible error in the difference of longitude. Though, when the several rhumb lines sailed over are nearly in the same direction, the error in longitude will be but small.

The reason of this will easily appear from the annexed figure, in which the ship is supposed to sail from Z to

A , along the rhumb lines ZB , BA ; for if the meridians PZ , $PkoeBL$ be drawn; and very near the latter other two meridians PhD , Pmn ; and likewise the parallels of latitude Bn , De , mo , hk ; then it is plain that De is greater than hk (for De is to hk as the sine of DP to the sine of hP): and since this is the case every where, the departure corresponding to the distance BZ and course BZC , will be greater than the departure to the distance oZ , and course oZC . And in the same manner, we prove that nB is greater than mo ; and consequently, the departure corresponding to the distance AB , and course ABL , is greater than the departure to the distance Ao , and course AoL : Wherefore, the sum of the two departures corresponding to the courses ABL and BZC , and to the distances AB and BZ , is greater than the departure corresponding to the distance AZ and course AZC : therefore the course answering to this sum as a departure, and CZ as a difference of latitude, (AC being the parallel of latitudes passing through A), will be greater than the true course AZC made good upon the whole. And hence the difference of longitude found by the common rules will be greater than the true difference of longitudes; and the error will be greater or less according as BA deviates more or less from the direction of BZ .



3. Of determining the ship's longitude by lunar observations.

Several rules for this purpose have been lately published, the principal object of which seems to have been to abbreviate the computations requisite for determining the true distance of the sun or a star from the moon's centre. This, however, should have certainly been less attended to than the investigation of a solution, in which considerable errors in the data may produce a small error in the required distance. When either of the luminaries has a small elevation, its altitude will be affected by the variable refractions of the atmosphere; likewise the altitude, as given by the quadrant, will be affected by the inaccuracy of the instrument, and the uncertainty necessarily attending all observations made.

Longitude. made at sea. The sum of these errors, when they all tend the same way, may be supposed to amount to at least one minute in altitude; which, in many cases, according to the common rules for computing the true distance, will produce an error of about 30 minutes in the longitude. Thus, in the example given by Monf. Callet, in the *Tables Portatives*, if we suppose an error of one minute in the sun's altitude, or call it $6^{\circ} 26' 34''$, instead of $6^{\circ} 27' 34''$; we shall find the alteration in distance according to his rule to be $54''$, producing an error of about 27 minutes in the longitude: for the angle at the sun will be found, in the spherical triangle whose sides are the complement of the sun's altitude, complement of the moon's altitude, and observed distance, to be about 26° ; and as radius is to the cosine of 26° , so is $60''$ the supposed error in altitude, to $54''$ the alteration in distance. Perhaps the only method of determining the distance, so as not to be affected by the errors of altitude, is that by first finding the angles at the sun and moon, and by the help of them the corrections of distance for parallax and refraction. The rule is as follows:

Add together the complement of the moon's apparent altitude, the complement of the sun's apparent altitude, and the apparent distance of centres; from half the sum of these subtract the complement of the sun's altitude, and add together the logarithmic co-secant of the complement of the moon's altitude, the logarithmic co-secant of the apparent distance of centres, the logarithmic sine of the half sum, and the logarithmic sine of the remainder; and half the sum of these four logarithms, after rejecting 20 from the index, is the logarithmic cosine of half the angle at the moon.

As radius is to the cosine of the angle at the moon; so is the difference between the moon's parallax and refraction in altitude to a correction of distance; which

is to be added to the apparent distance of centres Longitude. when the angle at the moon is obtuse; but to be subtracted when that angle is acute, in order to have the distance once corrected.

In the above formula, if the word *sun* be changed for *moon*, and *vice versa*, wherever these terms occur, we shall find a second correction of distance to be applied to the distance, once corrected by subtraction when the angle at the sun is obtuse, but by addition when that angle is acute, and the remainder or sum is the true distance nearly.

In applying this rule, it will be sufficient to use the complement, altitudes, and apparent distances of centres, true to the nearest minute only, as a small error in the angles at the sun and moon will very little affect the corrections of distances.

If D be the computed distance in seconds, d the difference between the moon's parallax and refraction in altitude, S the sine of the angle at the moon, and R the radius; then $\frac{d^2 S^2}{2DR}$ will be a third correction

of distance, to be added to the distance twice corrected: But it is plain, from the nature of this correction, that it may be always rejected, except when the distance D is very small, and the angle at the moon nearly equal to 90° .

This solution is likewise of use in finding the true distance of a star from the moon, by changing the word *sun* into *star*, and using the refraction of the star, instead of the difference between the refraction and parallax in altitude of the sun, in finding the second correction of distance.

Ex. Given the observed distance of a star from the centre of the moon, $50^{\circ} 8' 41''$; the moon's altitude, $55^{\circ} 58' 5''$; the star's altitude, $19^{\circ} 18' 5''$; and the moon's horizontal parallax, $1^{\circ} 0' 5''$: Required the true distance.

Cofec. — 0.02512	*'s co. alt. — 70° 42'	Cofec. — 0.25169
	☽'s co. alt. — 34 4	
Cofec. — 0.11479	obl. diff. — 50 9	Cofec. — 0.11479
	2) 154 55	
Sine — 9.98950	77 27	Sine — 9.98950
	Rem. 6 45	Sine — 9.07018
Sine — 9.83688	Rem. 43 23	2) 19.42616
2) 19.96629		Cofec. — 9.71308 — 58° 54'
Cofec. — 9.98314	15° 54'	2
	2	117 48 = ☽'s angle.
	31 48 = *'s angle.	
Rad. : Cofec. 117° 48' :	☽'s diff. parall. & refract. 1980'' :	923'' = 1st correct. of distance.
Rad. · Cofec. 31° 48' :	star's refract. 162'' :	138'' = 2d correct. of distance.

Here the first correction of distance is additive, since the angle at the moon is obtuse; and the second correction is also additive, since the angle at the star is acute: therefore their sum $923'' + 138'' = 1061'' = 17^{\circ} 41''$, being added to $50^{\circ} 8' 41''$, the apparent No 188.

distance of the star from the moon's centre, gives $50^{\circ} 26' 21''$ for the true distance of centres nearly; and $2 \times L (d + S) - L (2 L R + L 2 + L D) = L 8''$, which, being added to the distance twice corrected, gives $50^{\circ} 26' 29''$ for the true distance. By comparing

Longitude—ring this distance with the computed distances in the ephemeris, the time at Greenwich corresponding to that of observing the distance will be known; and the difference of those times being converted into degrees and minutes, at the rate of 15 degrees to the hour, will give the longitude of the place of observation; which will be east if the time at the place be greater than that at Greenwich, but west if it be less.

LONGITUDINAL, in general, denotes something placed lengthwise: thus some of the fibres in the vessels of the human body are placed longitudinally, others transversely or acroli.

LONGOBARDI. See **LANGOBARDI**.

LONGOMONTANUS (Christian), a learned astronomer, born in a village of Denmark in 1562. He was the son of a ploughman; and was obliged to suffer during his studies all the hardships to which he could be exposed, dividing his time, like the philosopher Ctesarchus, between the cultivation of the earth and the lessons he received from the minister of the place. At last, when he was 15, he stole away from his family, and went to Wiburg, where there was a college, in which he spent 11 year; and though he was obliged to earn a livelihood, he applied himself to study with such ardour, that among other science he learned the mathematics in great perfection. He afterwards went to Copenhagen; where the professors of that university in a short time conceived so high an opinion of him, that they recommended him to the celebrated Tycho Brahe. Longomontanus lived eight years with that famous astronomer, and wa. of great service to him in his observations and calculations. At length, being extremely desirous of obtaining a professor's chair in Denmark, Tycho Brahe consented, though with some difficulty, to deprive himself of his service; gave him a discharge, filled with the highest testimonies of his esteem; and furnished him with money for the expence of his long journey. He obtained a professorship of mathematics in the university of Copenhagen in 1605; and discharged the duty of it worthily till his death, which happened in 1617. He wrote many learned works; amused himself with endeavouring to square the circle, and pretended that he had made that discovery; but Dr John Pell, an English mathematician, attacked him warmly on that subject, and proved that he was mistaken.

LONGTOWN, a town of Cumberland, on the Scots borders, near the conflux of the Elk and Kirkfo, seven miles from Carlisle, and 313 miles from London; it has a market on Thursday, and a charity-school for 60 children, and two fairs in the year.

LONGUEVILLE, a town of France, in Upper Normandy, and in the territory of Caux, seated on the small river Lee, 17 miles north of Rouen. It has the title of a duchy. E. Long. 1. 10. N. Lat. 49. 46.

LONGWY, a town of France, on the frontiers of the duchy of Luxemburg, with a castle, divided into the old and new towns. This last was built and fortified by Louis XIV. It is seated on an eminence. E. Long. 5. 51. N. Lat. 40. 32.

LONGUS, a Greek poet, author of a book intitled *Novus*, or Pastoral, and a romance containing the loves of Daphnis and Chloe. Huettius, bishop of Avranches, speaks very advantageously of this work; but he censures the obscene touches with which it is

interperfed. None of the ancient authors mention him, so the time when he lived cannot be certainly fixed. There is an English translation of this author, which is ascribed to the late J. Craggs, Esq; secretary of state.

LONGICERA, **HONEYSUCKLE**, in botany: A genus of the monogynia order, belonging to the pentandria class of plants. The corolla is monopetalous and irregular; the berry polyfpermous, bilocular, and inferior.

Species. 1. The alpigena, or upright red-berried honeysuckle, rises with a shrubby, short, thick, upright stem, branching strong and erectly four or five feet high; largish, spear-shaped leaves, in pairs opposite; and from the sides of the branches many red flowers by two's on long footstalks, each succeeded by two red berries joined together at their base; it flowers in August, and the berries ripen in autumn. 2. The carulea, or blue-berried upright honeysuckle, rises with a shrubby upright stem, branching moderately three or four feet high, with many white flowers proceeding from the sides of the branches; appearing in May, and succeeded by blue berries joined together at their base. 3. The nigra, or black-berried upright honeysuckle, rises with a shrubby stem branching three or four feet high, with white flowers succeeded by single and distinct black-berries. 4. The tartarica, or Tartarian honeysuckle, rises with a shrubby upright stem, branching erectly three or four feet high; heart-shaped, opposite leaves, and whitish erect flowers succeeded by red berries, sometimes distinct, and sometimes double. 5. The diervilla, or yellow-flowered Arcadian honeysuckle, rises with shrubby upright stalks, branching erect to the height of three or four feet; the branches terminated by clusters of pale yellow flowers, appearing in May and June, and sometimes continuing till autumn; but rarely ripening seeds here. 6. The xylosteum, or fly honeysuckle rises with a strong shrubby stem, branching erect to the height of seven or eight feet; with erect white flowers proceeding from the sides of the branches; each succeeded by large double red berries, joined together at their base. The flowers appear in June, and the berries ripen in September. 7. The symphoricarpos, or shrubby St Peter's-wort, rises with a shrubby, rough stem, branching erect four or five feet high, with small greenish flowers appearing round the stalk in August. 8. The periclymenum, or common climbing honeysuckle, hath two principal varieties, viz. The English wild honeysuckle, or woodbine of our woods and hedges, and the Dutch or German honeysuckle. The former rises with shrubby, weak, very long slender stalks, and branches trailing on the ground, or climbing round any support; all terminated by oval imbricated heads, furnishing smallish flowers of white or red colours, and appearing from June or July till autumn. The Dutch honeysuckle rises with a shrubby declinated stalk, and long trailing purplish branches, terminated by oval imbricated heads, furnishing large beautiful red flowers of a fragrant odour, appearing in June and July. 9. The caprifolium, or Italian honeysuckle, rises with shrubby declinated stalks, sending out long slender trailing branches, terminated by verticillate or whorled bunches of close-fitting flowers, very fragrant, and white, red, and yellow colours. 10. The sempervirens, or evergreen trumpet-flowered honeysuckle,

Longicera.

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fuckle, rises with a flurby declinated stalk, sending out long slender trailing branches, terminated by naked verticillate spikes, of long, unreflexed, deep scarlet flowers, very beautiful, but of little fragrance.

Culture. The most easy method of propagating these plants is by layers or cuttings, especially the latter; both of these readily emit roots, and form plants in one year fit for transplantation. Some sorts are also propagated by suckers and feed.

LONSDALE, or *Kirkby LONSDALE*, a town of Westmoreland, seated on the river Lon, in a pleasant and rich valley of the same name. It is a large well-built town, has a handsome church, and a fine stone-bridge over the river. It is well inhabited; and is the best town in the county except Kendal. It gives title of Earl to the Lowther family. W. Long. 2. 27. N. Lat. 54. 10.

LOO, a town of the United Provinces, in Guelderland, eight miles west of Deventer, where the prince of Orange has a fine palace. E. Long. 6. 0. N. Lat. 52. 18.

LOOF, the after part of a ship's bow; or that part of her side forward where the planks begin to be incurved into an arch as they approach the stem.

LOOF, or *Luff*. See **LUFF**.

LOOK-OUT, in the sea-language, a watchful attention to some important object or event which is expected to arise from the present situation of a ship, &c. It is principally used in navigation when there is a probability of danger from the real or supposed proximity of land, rocks, enemies, and, in short, whatever peril she may encounter through inattention, which might otherwise have been avoided by a prudent and necessary vigilance.

There is always a look-out kept on a ship's fore-castle at sea, to watch for any dangerous objects lying near her track, and to which she makes a gradual approach as the advances: the mate of the watch accordingly calls often from the quarter-deck, "Look out afore there!" to the persons appointed for this service.

LOOKING-GLASSES, are nothing but plain mirrors of glass; which, being impervious to the light, reflect the images of things placed before them. See the articles **MIRROR** and **OPTICS**.

For the casting, grinding, and polishing of looking-glasses, see the article **GLASS**.

For foliating of looking-glasses. See the article **FOLIATING**.

LOOL, in metallurgy, a vessel made to receive the washings of ores of metals. The heavier or more metalline part of the ores remain in the trough in which they are washed; the lighter and more earthy run off with the water, but settle in the lool.

LOOM, the weaver's frame; a machine whereby several distinct threads are woven into one piece.

Looms are of various structures, accommodated to the various kinds of materials to be woven, and the various manner of weaving them; viz. for woollens, silks, linens, cottons, cloths of gold: and other works, as tapestry, ribbands, stockings, &c. divers of which will be found under their proper heads. See **WEAVING**.

The weaver's loom-engine, otherwise called the Dutch loom-engine, was brought into use from Holland to London, in or about the year 1676.

Heir-Loom, in law. See **HEIR-LOOM**.

LOOM, at sea. If a ship appears big, when at a distance, they say she looms, or appears a great sail: the term is also used to denote the indistinct appearance of any other distant objects.

LOOM-gale, at sea, a gentle ealy gale of wind, in which a ship can carry her top-sails a trip.

LOOP, in the iron works, is a part of a fow or block of cast iron broken or melted off from the rest, and prepared for the forge or hammer. The usual method is, to break off the loop of about three quarters of a hundred weight. This loop they take up with their slinging-tongs, and beat it with iron sledges upon an iron plate near the fire, that so it may not fall to pieces, but be in a condition to be carried under the hammer. It is then placed under the hammer, and a little water being drawn to make the hammer move but softly, it is beat very gently, and by this means the dross and foulness are forced off, and after this they draw more and more water by degrees, and beat it more and more till they bring it to a four-square mass, of about two feet long, which they call a bloom.

LOOPING, in metallurgy, a word used by the miners of some counties of England, to express the running together of the matter of an ore into a mass, in the roasting or first burning, intended only to calcine it so far as to make it fit for powdering. This accident, which gives the miners some trouble, is generally owing to the continuing the fire too long in this process.

LOOSE-STRIPE. See **LYSIMACHIA**.

LOOSA, in botany: A genus of the monogynia order, belonging to the polyandria class of plants. The calyx is pentaphyllous, superior; there are five sub-ovate, cucullated, and large petals; the nectarium consists of five leaves, gathered into a conical figure, each terminated by two filaments; the capsule is turbinate, unilocular, and trivalved at top; the seeds are very numerous; and there are three linear and longitudinal sinuses.

LOPES LE VEGA. See **VEGA**.

LOPEZ, or **INDIAN**, Root, in the materia medica.

The plant to which this article belongs is unknown. Neither the woody nor cortical part of the root has any remarkable sensible quality. A slight bitterness is perceptible; and it is recommended, like simarouba, in diarrhoeas even of the colliquative kind, in half-dram doses four times a-day. Little of this root has been brought to Europe: but some of those who have had an opportunity of employing it, speak in very high terms of the effects obtained from it.

LOPHIUS, **FISHING-FROG**, *Toad-fish*, or *Sea-devil*; a genus of the branchiostegious order of fishes, whose head is in size equal to all the rest of the body. There are three species; the most remarkable of which is the plicatorius, or common fishing-frog, an inhabitant of the British seas. This singular fish was known to the ancients by the name of *βατραχίς*, and *rana*; and to us by that of the *fishing-frog*, for it is of a figure resembling that animal in a tadpole state. Pliny takes notice of the artifice used by it to take its prey: *Eminentia sub oculis cornicula turbato limo exerit, affusillantes pisciculos attrahens, donec tam prope accedunt, ut assillat.* "It puts forth the slender horns it has beneath its eyes, enticing by that means the little fish to play round, till they come within reach, when it springs

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on them." The fishing-frog grows to a large size, some being between four and five feet in length; and Mr Pennant mentions one taken near Scarborough, whose mouth was a yard wide. The fishermen on that coast have a great regard for this fish, from a supposition that it is a great enemy to the dog-fish; and whenever they take it with their lines, let it at liberty.

It is a fish of very great deformity: the head is much bigger than the whole body; is round at the circumference, and flat above; the mouth of a prodigious wideness. The under jaw is much longer than the upper: the jaws are full of slender sharp teeth: in the roof of the mouth are two or three rows of the same: at the root of the tongue, opposite each other, are two bones of an elliptical form, thick set, with very strong sharp teeth. The nostrils do not appear externally, but in the upper part of the mouth are two large orifices that serve instead of them. On each side the upper-jaw are two sharp spines, and others are scattered about the upper part of the head. Immediately above the nose are two long tough filaments, and on the back three others; these are what Pliny calls *cornicula*, and says it makes use of to attract the little fish. They seem to be like lines flung out for that end. Along the edges of the head and body are a multitude of short fringed skins, placed at equal distances. The aperture to the gills is placed behind; each of these is very wide, so that some writers have imagined it to be a receptacle for the young in time of danger. The body grows slender near the tail, the end of which is quite even. The colour of the upper part of this fish is dusky, the lower part white; the skin smooth.

LORANTHUS, in botany: A genus of the monogynia order, belonging to the hexandria class of plants; and in the natural method ranking under the 48th order, *Aggrogata*. The germen is inferior; there is no calyx; the corolla is sixfold and revolved; the stamina are at the tops of the petals; the berry is monospermous. There is only one species, a native of America, discovered by Father Plumier, and found growing naturally at La Vera Cruz by Dr Houlton. It rises with a shrubby stalk, eight or ten feet high, dividing into several branches, having at their ends clusters of small scarlet-coloured flowers, succeeded by oval berries with a pulpy covering, and a hard shell with one cell, inclosing several compressed seeds. It is propagated by seeds, which should be sown soon after they are ripe; otherwise they are very apt to miscarry, or lie a year in the ground without germinating. The plants require always to be kept in a bark-love.

LORARI, among the Romans, officers whose business it was, with whips and scourges, to compel the gladiators to engage. The *lorarii* also punished slaves who disobeyed their masters.

LORD, a title of honour given to those who are noble either by birth or creation. In this sense, it amounts to much the same as *peer of the realm*, or *lord of parliament*. The title is by courtesy also given to all the sons of dukes and marquises, and to the eldest sons of earls; and it is also a title of honour bestowed on those who are honourable by their employments; as *lord advocate*, *lord chamberlain*, *lord chancellor*, &c. The word is Saxon, but abbreviated from two syllables into one; for it was originally *Illoford*,

which by dropping the aspiration became *Laford*, and afterwards by contraction *Lord*. "The etymology of the word (says J. Coates) is well worth observing; for it was composed of *ilof* "a loaf of bread," and *ford* "to give or afford;" so that *Illoford*, now *Lord*, implies "a giver of bread;" because, in those ages, such great men kept extraordinary houses, and fed all the poor; for which reason they were called *givers of bread*, a thing now much out of date, great men being fond of retaining the title, but few regarding the practice for which it was first given. See **LADY**.

House of Lords, one of the three estates of parliament, and composed of the Lords Spiritual and Temporal.

1. The *Spiritual Lords* consist of 2 archbishops and 24 bishops; and, at the dissolution of monasteries by Henry VIII, consisted likewise of 26 retired abbots and two priors: a very considerable body, and in those times equal in number to the temporal nobility. All these hold, or are supposed to hold, certain ancient baronies under the king: for William the Conqueror thought proper to change the spiritual tenure of frank-almoign or free-alms, under which the bishops held their lands during the Saxon government, into the feudal or Norman tenure by barony; which subjected their estates to all civil charges and assessments, from which they were before exempt; and in right of succession to those baronies, which were unalienable from their respective dignities, the bishops and abbots were allowed their seats in the house of lords. But though these lords spiritual are in the eye of the law a distinct estate from the lords temporal, and are so distinguished in most of our acts of parliament; yet in practice they are usually blended together under the name of *the lords*; they intermix in their votes, and the majority of such intermixture joins both estates. And from this want of a separate assembly, and separate negative of the prelates, some writers have argued very cogently, that the lords spiritual and temporal are now in reality only one estate: which is unquestionably true in every effectual sense, though the ancient distinction between them still nominally continues. For if a bill should pass their house, there is no doubt of its validity, tho' every lord spiritual should vote against it; of which Selden and Sir Edward Coke give many instances: as, on the other hand, doubtless it would be equally good, if the lords temporal present were inferior to the bishops in number, and every one of those temporal lords gave his vote to reject the bill; though this Sir Edward Coke seems to doubt of.

2. The *Temporal Lords* consist of all the peers of the realm, (the bishops not being in strictness held to be such, but merely lords of parliament,) by whatever title of nobility distinguished; dukes, marquises, earls, viscounts, or barons†. Some of these fit by descent, † See Nobility. as do all ancient peers; some by creation, as do all new-made ones; others, since the union with Scotland, by election, which is the case of the 16 peers, who represent the body of the Scots nobility. Their number is indefinite, and may be increased, at will by the power of the crown; and once, in the reign of Queen Anne, there was an instance of creating no less than 12 together; in contemplation of which, in the reign of King George I. a bill passed the house of lords, and

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was countenanced by the then ministry, for limiting the number of the peerage. This was thought by some to promise a great acquisition to the constitution, by restraining the prerogative from gaining the ascendant in that august assembly, by pouring in at pleasure an unlimited number of new-created lords. But the bill was ill relished, and miscarried in the house of commons, whose leading members were then desirous to keep the avenues to the other house as open and easy as possible.

The distinction of ranks and honours is necessary in every well-governed state: in order to reward such as are eminent for their services to the public, in a manner the most desirable to individuals, and yet without burthen to the community; exciting thereby an ambitious yet laudable ardour and generous emulation in others. And emulation, or virtuous ambition, is a spring of action which, however dangerous or invidious in a mere republic or under a despotic sway, will certainly be attended with good effects under a free monarchy; where, without destroying its existence, its excesses may be continually restrained by that superior power from which all honour is derived. Such a spirit, when nationally diffused, gives life and vigour to the community; it sets all the wheels of government in motion, which, under a wise regulator, may be directed to any beneficial purpose; and thereby every individual may be made subservient to the public good, while he principally means to promote his own particular views. A body of nobility is also more particularly necessary in our mixed and compounded constitution, in order to support the rights of both the crown and the people, by forming a barrier to withstand the encroachments of both. It creates and preserves that gradual scale of dignity which proceeds from the peasant to the prince; rising like a pyramid from a broad foundation, and diminishing to a point as it rises. It is this ascending and contracting proportion that adds stability to any government; for when the departure is sudden from one extreme to another, we may pronounce that state to be precarious. The nobility therefore are the pillars, which are reared from among the people, more immediately to support the throne; and, if that falls, they must also be buried under its ruins. Accordingly, when in the last century the commons had determined to extirpate monarchy, they also voted the house of lords to be useless and dangerous. And since titles of nobility are thus expedient in the state, it is also expedient that their owners should form an independent and separate branch of the legislature. If they were confounded with the mass of the people, and like them had only a vote in electing representatives, their privileges would soon be borne down and overwhelmed by the popular torrent, which would effectually level all distinctions. It is therefore highly necessary that the body of nobles should have a distinct assembly, distinct deliberations, and distinct powers from the commons. See also KING, NOBILITY, PARLIAMENT, COMMONS, and COMMONALTY.

As to the peculiar laws and customs relating to the house of lords: One very ancient privilege is that declared by the charter of the forest, confirmed in parliament 9 Hen. III.; viz. that every lord spiritual or temporal summoned to parliament, and passing through

the king's forests, may, both in going and returning, kill one or two of the king's deer without warrant; in view of the forester if he be present, or on blowing a horn if he be absent; that he may not seem to take the king's venison by stealth.

In the next place, they have a right to be attended, and constantly are, by the judges of the court of king's-bench and common-pleas, and such of the barons of the exchequer as are of the degree of the coif, or have been made serjeants at law; as likewise by the king's learned council, being serjeants, and by the masters of the court of chancery; for their advice in point of law, and for the greater dignity of their proceedings. The secretaries of state, with the attorney and solicitor general, were also used to attend the house of peers, and have to this day (together with the judges, &c.) their regular writs of summons issued out at the beginning of every parliament, *ad tractandum et consilium impendendum*, though not *ad consentiendum*: but, whenever of late years they have been members of the house of commons, their attendance here hath fallen into disuse.

Another privilege is, that every peer, by licence obtained from the king, may make another lord of parliament his proxy, to vote for him in his absence: A privilege, which a member of the other house can by no means have, as he is himself but a proxy for a multitude of other people.

Each peer has also a right, by leave of the house, when a vote passes contrary to his sentiments, to enter his dissent on the journals of the house, with the reasons for such dissent; which is usually styled his protest.

All bills likewise, that may in their consequences any way affect the rights of the peerage, are by the custom of parliament to have their first rise and beginning in the house of peers, and to suffer no changes or amendments in the house of commons.

There is also one statute peculiarly relative to the house of lords; 6 Ann. c. 23. which regulates the election of the 16 representative peers of North Britain, in consequence of the 22d and 23d articles of the union: and for that purpose prescribes the oaths, &c. to be taken by the electors; directs the mode of balloting; prohibits the peers electing from being attended in an unusual manner; and expressly provides, that no other matter shall be treated of in that assembly, save only the election, on pain of incurring a præmunire. See also the articles NOBILITY and PEERS.

LORDOSIS, (of *καρδος*, bent inwards), in the medical writings, a name given to a distempered state of the spine, in which it is bent inwards, or toward the anterior parts. It is used in opposition to *gibbus*, or *hump-backed*. See SURGERY.

LORETTO, a town of Italy, in the Marca or Marche of Ancona, with a bishop's see. It is small, but fortified; and contains the famous *casa santa*, or holy chapel, so much visited by pilgrims. This chapel, according to the legend, was originally a small house in Nazareth, inhabited by the virgin Mary, in which she was saluted by the angel, and where she bred our Saviour. After their deaths, it was held in great veneration by all believers in Jesus, and at length consecrated into a chapel, and dedicated to the virgin; upon which occasion St Luke made that identical image,

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image, which is still preserved here, and dignified with the name of our Lady of Loretto. This sanctified edifice was allowed to sojourn in Galilee as long as that district was inhabited by Christians; but when infidels got possession of the country, a band of angels, to save it from pollution, took it in their arms, and conveyed it from Nazareth to a castle in Dalmatia. This fact might have been called in question by incredulous people, had it been performed in a secret manner; but, that it might be manifest to the most short-sighted spectator, and evident to all who were not perfectly deaf as well as blind, a blaze of celestial light, and a concert of divine music, accompanied it during the whole journey; besides, when the angels, to rest themselves, let it down in a little wood near the road, all the trees of the forest bowed their heads to the ground, and continued in that respectful posture as long as the sacred chapel remained among them. But, not having been entertained with suitable respect at the castle above mentioned, the same indefatigable angels carried it over the sea, and placed it in a field belonging to a noble lady called *Lauretta*, from whom the chapel takes its name. This field happened unfortunately to be frequented at that time by highwaymen and murderers: a circumstance with which the angels undoubtedly were not acquainted when they placed it there. After they were better informed, they removed it to the top of a hill belonging to two brothers, where they imagined it would be perfectly secure from the dangers of robbery or assassination; but the two brothers, the proprietors of the ground, being equally enamoured of their new visitor, became jealous of each other, quarrelled, fought, and fell by mutual wounds. After this fatal catastrophe, the angels in waiting finally moved the holy chapel to the eminence where it now stands, and has stood these 400 years, having lost all relish for travelling.

The sacred chapel stands due east and west, at the farther end of a large church of the most durable stone of Itria, which has been built around it. This may be considered as the external covering, or as a kind of great coat to the *casa santa*, which has a smaller coat of more precious materials and workmanship nearer its body. This internal covering or case is of the choicest marble, after a plan of San Savino's, and ornamented with basso relievos, the workmanship of the best sculptors which Italy could furnish in the reign of Leo X. The subject of those basso relievos are, the history of the blessed virgin, and other parts of the Bible. The whole case is about 50 feet long, 30 in breadth, and the same in height; but the real house itself is no more than 32 feet in length, 14 in breadth, and at the sides about 18 feet in height; the centre of the roof is four or five feet higher. The walls of this little holy chapel are composed of pieces of a reddish substance, of an oblong square shape, laid one upon another, in the manner of brick. At first sight, on a superficial view, these red-coloured oblong substances appear to be nothing else than common Italian bricks; and, which is still more extraordinary, on a second and third view, with all possible attention, they still have the same appearance. Travellers, however, are assured, with great earnestness, that there is not a single particle of brick in their whole composition, being entirely of a stone, which, though it cannot now be

found in Palestine, was formerly very common, particularly in the neighbourhood of Nazareth.

Loretto.

The holy house is divided within into two unequal portions, by a kind of grate-work of silver. The division towards the west is about three-fourths of the whole; that to the east is called the *Sanctuary*. In the larger division, which may be considered as the main body of the house, the walls are left bare, to show the true original fabric of Nazareth stone; for they must not be supposed to be bricks. At the lower or western wall there is a window, the same through which the angel Gabriel entered at the Annunciation. The architraves of this window are covered with silver. There are a great number of golden and silver lamps in this chapel: one of the former, a present from the republic of Venice, is said to weigh 37 pounds, and some of the silver lamps weigh from 120 to 130 pounds. At the upper end of the largest room is an altar, but so low, that from it you may see the famous image which stands over the chimney in the small room or sanctuary. Golden and silver angels, of considerable size, kneel around her, some offering hearts of gold, enriched with diamonds, and one an infant of pure gold. The wall of the sanctuary is plated with silver, and adorned with crucifixes, precious stones, and votive gifts of various kinds. The figure of the Virgin herself by no means corresponds with the fine furniture of her house: She is a little woman, about four feet in height, with the features and complexion of a negro. Of all the sculptors that ever existed, assuredly St Luke, by whom this figure is said to have been made, is the least of a flatterer; and nothing can be a stronger proof of the blessed Virgin's contempt for external beauty, than her being satisfied with this representation of her. The figure of the infant Jesus, by St Luke, is of a piece with that of the Virgin: he holds a large golden globe in one hand, and the other is extended in the act of blessing. Both figures have crowns on their heads, enriched with diamonds: these were presents from Ann of Austria queen of France. Both arms of the Virgin are inclosed within her robes, and no part but her face is to be seen; her dress is most magnificent, but in a wretched bad taste: this is not surprising, for she has no female attendant. She has particular clothes for the different feasts held in honour of her, and, which is not quite so decent, is always dressed and undressed by the priests belonging to the chapel; her robes are ornamented with all kinds of precious stones down to the hem of her garment.

There is a small place behind the sanctuary, in which are shown the chimney, and some other furniture, which they pretend belonged to the Virgin when she lived at Nazareth; particularly a little earthen porringer, out of which the infant used to eat. The pilgrims bring rosaries, little crucifixes, and Agnus Dei's, which the obliging priest shakes for half a minute in this dish; after which it is believed they acquire the virtue of curing various diseases, and prove an excellent preventive of all temptations of Satan. The gown which the image had on when the chapel arrived from Nazareth is of red camblet, and carefully kept in a glass shrine.

Above 100 masses are daily said in this chapel, and in the church in which it stands. The jewels and riches

riches to be seen at any one time in the holy chapel are of small value in comparison of those in the treasury, which is a large room adjoining to the veltry of the great church. In the pressies of this room are kept those presents which royal, noble, and rich bigots of all ranks, have, by oppressing their subjects and injuring their families, sent to this place. To enumerate every particular would fill volumes. They consist of various utensils and other things in silver and gold; as lamps, candlesticks, goblets, crowns, and crucifixes; lambs, eagles, saints, apostles, angels, virgins, and infants: then there are cameos, pearls, gems, and precious stones, of all kinds and in great numbers. What is valued above all the other jewels is, the miraculous pearl, wherein they assert that Nature has given a faithful delineation of the Virgin sitting on a cloud with the infant Jesus in her arms. There was not room in the pressies of the treasury to hold all the silver pieces which have been presented to the Virgin. Several other pressies in the veltry are completely full. It is said that those pieces are occasionally melted down by his holiness for the use of the state; and also that the most precious of the jewels are picked out and sold for the same purpose, false stones being substituted in their room.

Pilgrimages to Loretto are not so frequent with foreigners, or with Italians of fortune and distinction, as formerly; nineteen out of twenty of those who make this journey now are poor people, who depend for their maintenance on the charity they receive on the road. To those who are of such a rank in life as precludes them from availing themselves of the charitable institutions for the maintenance of pilgrims, such journeys are attended with expence and inconvenience; and fathers and husbands, in moderate or confined circumstances, are frequently brought to disagreeable dilemmas, by the rash vows of going to Loretto which their wives or daughters are apt to make on any supposed deliverance from danger. To refuse, is considered by the whole neighbourhood as cruel, and even impious; and to grant, is often highly distressing, particularly to such husbands as, from affection or any other motive, do not choose that their wives should be long out of their sight. But the poor, who are maintained during their whole journey, and have nothing more than a bare maintenance to expect from their labour at home, to them a journey to Loretto is a party of pleasure as well as devotion, and by much the most agreeable road they can take to heaven. The greatest concourse of pilgrims is at the seasons of Easter and Whitsuntide. The rich travel in their carriages: A greater number come on horseback or on mules; or, what is still more common, on asses. Great numbers of females come in this manner, with a male friend walking by them as their guide and protector; but the greatest number of both sexes are on foot. The pilgrims on foot, as soon as they enter the suburbs, begin a hymn in honour of the Virgin, which they continue till they reach the church. The poorer sort are received into an hospital, where they have bed and board for three days.

The only trade of Loretto consists of rosaries, crucifixes, little Madonas, Agnus Dei's, and medals, which are manufactured here, and sold to pilgrims. There are great numbers of shops full of these com-

modities, some of them of a high price; but infinitely the greater part are adapted to the purses of the buyers, and sold for a mere trifle. The evident poverty of those manufacturers and traders, and of the inhabitants of this town in general, is a sufficient proof that the reputation of our Lady of Loretto is greatly on the decline.

In the great church which contains the holy chapel are confessionalis, where the penitents from every country of Europe may be confessed in their own language, priests being always in waiting for that purpose: each of them has a long white rod in his hand, with which he touches the heads of those to whom he thinks it proper to give absolution. They place themselves on their knees in groupes around the confessional chair; and when the holy father has touched their heads with the expiatory rod, they retire, freed from the burden of their sins, and with renewed courage to begin a fresh account.

In the spacious area before this church there is an elegant marble fountain, supplied with water from an adjoining hill by an aqueduct. Few even of the most inconsiderable towns of Italy are without the useful ornament of a public fountain. The embellishments of sculpture and architecture are employed with great propriety on such works, which are continually in the people's view; the air is refreshed and the eye delighted by the streams of water they pour forth; a sight peculiarly agreeable in a warm climate. In this area there is also a statue of Sixtus V. in bronze. Over the portal of the church itself is a statue of the Virgin; and above the middle gate is a Latin inscription, importing, that within is the house of the mother of God, in which the Word was made flesh. The gates of the church are likewise of bronze, embellished with basso relievos of admirable workmanship; the subjects taken partly from the Old and partly from the New Testament, and divided into different compartments. As the gates of this church are shut at noon, the pilgrims who arrive after that time can get no nearer the *santa casa* than these gates, which are by this means sometimes exposed to the first violence of that holy ardour which was designed for the chapel itself. All the sculpture upon the gates which is within reach of the mouths of those zealots, is in some degree effaced by their kisses.

There are also several paintings to be seen here, some of which are highly esteemed, particularly two in the treasury. The subject of one of these is the Virgin's Nativity, by Annibal Carracci; and of the other, a Holy Family, by Raphael. There are some others of considerable merit which ornament the altars of the great church. These altars, or little chapels, of which this fabric contains a great number, are lined with marble and embellished by sculpture; but nothing within this church interests a traveller of sensibility so much as the iron grates before those chapels, which were made of the fetters and chains of the Christian slaves, who were freed from bondage by the glorious victory of Lepanto.

The place where the governor resides stands near the church, and the ecclesiastics who are employed in it lodge in the same palace, where they receive the pilgrims of high distinction. The environs of this town are very agreeable, and in fine weather the high mountains

Lorica
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Loricæ.

mountains of Croatia may be seen from hence. It is seated on a mountain, in E. Long. 13. 50. N. Lat. 43. 24.

LORICA, was a cuirass, brigantine, or coat of mail, in use among the Roman soldiers. It was generally made of leather, and is supposed to be derived from *lorum*.—The lorice were fet with plates of metal in various forms; sometimes in hooks or rings like a chain, sometimes like feathers, and sometimes like the scales of serpents or fishes, to which plates of gold were often added. There were other lighter cuirasses consisting only of many folds of linen cloth, or of flax made strong enough to resist weapons. Such soldiers as were rated under 1000 drachms, instead of the lorica now described, wore a *peitoralæ*.—The Roman lorica was made like a shirt, and defended the wearer both before and behind, but was so contrived that the back part could be occasionally separated from the front. Some of the lorice were made of cords of hemp or flax, close set together; whence they are called *thoracæ*, *lilicæ*, *trilicæ*, &c. from the number of the cords fixed one upon another; but these were used rather in hunting than in the field of battle.

LORICATION, or **COATING**, in chemistry, is the covering a glass or earthen vessel with a coat or crust of a matter able to resist the fire, to prevent its breaking in the performing an operation that requires great violence of fire. See **CHEMISTRY**.

LORIS, in zoology. See **LEMUR**.

LORIMERS, one of the companies of London, that make bits for bridles, spurs, and such like small iron ware. They are mentioned in statute 1 Rich. II. c. 12.—The word seems derived from the Latin word *lorum*, “a thong.”

LORME (Philibert de), one of the most celebrated architects in the 16th century, was born at Lyons. Queen Catherine de Medicis gave him the superintendence of buildings; and he had the direction of those of the Louvre, the Thuilleries, the castle of St Anet, St Germain, and other edifices erected by her orders. He wrote several books of architecture, which are esteemed; and died about the year 1577.

LORNE, a division of Argyleshire in Scotland, which gives the title of marquis to the duke of Argyle. It extends above 30 miles in length from north to south, and about nine at its utmost breadth; bounded on the east by Braidalbin; on the west, by the islands; on the north, by Lochaber; and is divided from Knapdale on the south by Loch Etive, on the banks of which stands the castle of Bergomarn, wherein the courts of justice were anciently held. This district, abounding with lakes, is the most pleasant and fertile part of Argyleshire, producing plenty of oats and barley. It once belonged to the ancient family of Macdougall, still residing on the spot; but devolved to the lords of Argyle in consequence of a marriage with the heiress, at that time a branch of the Stuart family. The chief place of note in this district is the castle of Dunstaffnage, a seat of the Scottish kings previous to the conquest of the Picts in 843 by Kenneth II. In this place was long preserved the famous stone, the palladium of North Britain; brought, says legend, out of Spain, where it was first used as a seat of justice by Gathelus, coeval with Moses. It continued here as the coronation-chair till the reign of

Lorrie,
Lorrain.

Kenneth II. who removed it to Scoone, in order to secure his reign; for, according to the inscription,

*Ni sollet situm, Scoti quocunque locatum
Invocient lapidem, regnare te auctor ibidem.*

Some of the ancient regalia were preserved till the present century, when the keeper's servants, during his infirm years, embellished them for the silver ornaments; and left only a battle-axe, nine feet long, of beautiful workmanship, and ornamented with silver.

The castle is square; the inside only 87 feet; partly ruinous, partly habitable. At three of the corners are round towers; one of them projects very little. The entrance is towards the sea at present by a staircase, in old times probably by a draw-bridge, which fell from a little gate-way. The masonry appears very ancient; the tops battlemented. This pile is seated on a rock at the mouth of Loch Etive, whose waters expand within to a beautiful bay, where ships may safely ride in all weather. Of this building, the founder of which is unknown, nothing remains except the outer walls, which, though roofless, are still in good order; and within which some buildings have been erected, which serve as the residence of the laird. The duke of Argyle is hereditary keeper under the Crown.—At a small distance from the castle is a ruined chapel, once an elegant building; and at one end an inclosure, a family-cemetery. Opposite to these is a high precipice, ending abrupt and turning suddenly toward the south-east. A person concealed in the recesses of the rock, a little beyond the angle, surprises friends stationed at some distance beneath the precipice with a very remarkable echo of any word, or even sentence, he pronounces; which reaches the last distinct and unbroken. The repetition is single, but remarkably clear.

In 1397, this castle was possessed by Alexander Macdougall lord of Argyle, a friend to the English; but was that year reduced by Robert Bruce, when Macdougall sued for peace with that prince, and was received into favour.

We find, about the year 1455, this to have been a residence of the lords of the isles; for here James last earl of Douglas, after his defeat in Annandale, fled to Donald, the regulus of the time, and prevailed on him to take arms and carry on a plundering war against his monarch James II.

The situation of this regal seat was calculated for pleasure as well as strength. The views of mountains, valleys, waters, and islands, are delightful. On the north side of Loch Etive stood the town of Beregonium, supposed to have been the capital of the West Highlands. It seems, from certain mounds, excavations, and other appearances, to have been a strong fortress, to prevent invasion, or to secure a retreat, as occasions might require. On the bank of the same loch is the site of Ardhattan, a priory of monks of Valliscaulium in Burgundy, founded in 1230 by Donald Macdougall, ancestor of the Macdougalls of Lorne. Here Robert Bruce, who remained master of this country before he got entire possession of Scotland, held a parliament or council.—The country abounds in Druidical, Danish, and other monuments.

LORRAIN, a sovereign state of Europe, bounded on the north by Luxemburg and the archbishopric of Treves, on the east by Alsace and the duchy of Deux

Ponts,

Lorraine,
Loten.

Ponts, on the south by Franche Comté, and on the west by Champagne and the duchy of Bar. It is about 100 miles in length, and 75 in breadth; and abounds in all sorts of corn, wine, hemp, flax, rape-seed, game, and fish, with which it carries on some trade, and in general all the necessaries of life. There are fine meadows and large forests, with mines of iron, silver, and copper, as also salt-pits. There are a great number of rivers; of which the principal are the Maas or Meuse, the Moselle, the Scille, the Meure, and the Sarre. It is divided into three parts; the duchy of Lorraine, properly so called, which was heretofore a sovereign state; the duchy of Barr, which formerly belonged to the dukes of Lorraine, but afterwards came under the government of France; and the third comprehends the three bishoprics of Metz, Toul, and Verdun, which have belonged to France ever since the year 1552. In 1733, the emperor of Germany being at war with France, this last got possession of the duchy of Lorraine; and when there was a peace made in 1735, it was agreed, that Stanislaus king of Poland, father-in-law to the king of France, should possess these duchies, and that after his death they should be united for ever to the crown of France. It was also then agreed, that Francis Stephen, duke of Lorraine, and the emperor's son-in-law, should have the grand duchy of Tuscany as an equivalent for Lorraine. After the death of the great duke of Tuscany, in 1737, King Stanislaus and the duke of Lorraine took possession of their respective dominions, and the cessation was confirmed and guaranteed by a treaty in 1738. The inhabitants are laborious and valiant, and their religion is the Roman Catholic. They have but little trade with strangers, because they have no navigable rivers, and because they have all necessaries within themselves; but what little trade they have consists of corn and linen cloth. Nancy is the capital town.

LORRAIN (Robert le), an eminent sculptor, born at Paris in 1666. From his infancy, he made so rapid a progress in the art of designing, that at the age of 18 the celebrated Girardon intrusted him with the care of teaching his children and correcting his disciples. He committed to him also, in conjunction with Noulisson, the execution of the famous tomb of Cardinal Richelieu in the Sorbonne, and his own tomb at St Landres in Paris. On his return from Rome, he finished several pieces at Marfeilles, which had been left imperfect by the death of Mr Puget. He was received into the academy of sculpture in 1701. His *chief d'œuvre* is Galatea, a work universally admired. Lorraine afterwards made a Bacchus for the gardens at Versailles, a Faun for those of Marly; and several bronzes, among which is an Andromeda; all in an excellent taste. This artist succeeded chiefly in heads; and more particularly in that of young girls, which he performed with incomparable delicacy and truth.

LORRAIN (Claude.) See CLAUDE.

LOTEN (John), a good landscape painter of the English school; though a native of Switzerland. His taste led him to solemn and dreary scenes, as landstorms accompanied with showers of rain, &c. and he seldom omitted to introduce oak-trees in his prospects; his landscapes are generally large; and he painted with nature, truth, and force. But the effect of his composition had been much greater if he had been less cold

Nº 188.

in his colouring: for the judicious eye is not pleased with the darkish tint that predominates in it. He died in London about 1681.

Lothian.

LOTHIAN, a name given to three counties of Scotland, viz. Haddington-shire, Edinburgh-shire, and Linlithgow-shire; otherwise called *East, Mid, and West Lothians*.

1. East Lothian, or Haddington-shire, is bounded on the north-west by the Frith of Forth; and on the east by the German Sea; on the south-east by Berwickshire; and on the west by the county of Edinburgh. It extends about 25 miles from east to west, and where broadest, nearly 15 from north to south. The coast, advancing northward into the Frith, forms an irregular curve.—This is one of the most fruitful counties in Scotland, producing great quantities of wheat and all sorts of grain, well-watered, and plentifully supplied with fish, fowl, fuel, and all the necessaries of life. It abounds with towns, villages, and farms, interperfed with a great number of agreeable houses belonging to persons of rank and fortune. For cultivation, populousness, and fertility, this shire may vie with any tract of land in the island of Great Britain. Over and above the farming, which turns out to great account, the people towards the sea-coast employ themselves in the fishery, salt-making, and in foreign trade; and some of the more inland inhabitants engage in the linen and woollen manufactures. Limestone and coal are found in most parts of the country, and great numbers of sheep are fed on the hills of Lammermuir.

2. Edinburgh-shire, or Mid-Lothian, is about 35 miles long, but varies in its breadth in different places from five to 16 miles. It is bounded on the east by Haddington-shire; on the west by the shire of Linlithgow; on the south, by Tweeddale or Peebles-shire; and on the north, by part of West-Lothian and the Frith of Forth. The aspect of the country is in general level and pleasant, interperfed with a few hills, that help to exhibit agreeable prospects. It is well watered with rivers, and shaded with woods. It produces plenty of coal, lime-stone, a soft black marble, and some copper ore. The soil, of itself fertile, is finely cultivated, and yields as plentiful harvests of excellent wheat as are found in any part of Great Britain. The whole shire is interperfed with noble houses and plantations belonging to noblemen and gentlemen of fortune. The farmers are master of the science of agriculture; and wealthy in consequence of their skill, some of them paying 500*l.* of yearly rent. The country is well inhabited, and presents us with a good number of towns and populous villages. Along the sea-coast the common people subsist by fishing, and traffic in coals and salt, and some few carry on a smuggling commerce. Those in the inland are employed in farming, and some branches of the weaving manufacture. The sheriffalty of this shire is in the gift of the crown; and Edinburgh is a county in itself.

3. The shire of Linlithgow, or West Lothian, is bounded on the north by the Frith of Forth. The small river Almond divides it from Edinburgh-shire on the east. On the south-west it joins the county of Lanerk; and on the west it is parted from Stirling-shire by Avon, a small river. Its form, though irregular,

Lotion
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Lottery.

regular, approaches to a parallelogram. It measures from north-east to south-west, nearly 20 miles. Its breadth, except on the shore of the Frith, does not exceed 12.—The country is pleasant and fertile, abounding with corn and pasturage. Here is found plenty of coal, limestone, and lead ore; nay, in the reign of James VI. it produced a rich mine of silver.

LOTION, is, strictly speaking, such washing as concerns beautifying the skin, by cleansing it of those deformities which a distempered blood throws upon it. Medicines of this kind, however, are for the most part insignificant, and sometimes very dangerous; the only proper method of treating these disorders is, by administering such medicines as tend to correct the morbid state of the constitution from whence they arise.

LOTION, in pharmacy, denotes a preparation of medicines, by washing them in some liquid, either made very light, so as to take away only the dregs; or sharp, so as to penetrate them, in order to clear them of some salt, or corrosive spirit as is done to antimony, precipitates, magisteries, &c. or intended to take away some foulness or ill quality, or to communicate some good one.

LOTAPHAGI (anc. geog.), a people of the Regio Syrtica (so called from their living on the lotus); inhabiting between the two Syrtis, from the Cynusphus to the Triton. The lotus was said to be a food so luscious, as to make strangers forget their native country. A sweet wine was expressed from it, which did not keep above ten days, (Pliny). Lotophagi of Homer. See MENINX.

LOTTERY, a kind of public game at hazard, frequent in Britain, France, and Holland, in order to raise money for the service of the state; being appointed with us by the authority of parliament, and managed by commissioners appointed by the lords of the treasury for that purpose. It consists of several numbers of blanks and prizes, which are drawn out of wheels, one of which contains the numbers, and the other the corresponding blanks or prizes.

The Romans invented lotteries to enliven their Saturnalia. This festival began by the distribution of tickets which gained some prize. Augustus made lotteries which consisted of things of little value; but Nero established some for the people, in which 1000 tickets were distributed daily, and several of those who were favoured by Fortune got rich by them. Heliogabalus invented some very singular: the prizes were either of great value or of none at all; one gained a prize of six slaves, and another of six flies; some got valuable vases, and others vases of common earth. A lottery of this kind exhibited an excellent picture of the inequality with which Fortune distributes her favours.

The first English lottery we find mentioned in history was drawn A. D. 1569. It consisted of 40,000 lots, at 10s. each lot: the prizes were plate; and the profits were to go towards repairing the havens of this kingdom. It was drawn at the west door of St Paul's cathedral. The drawing began on the 11th of January 1569, and continued incessantly drawing, *day and night*, till the 6th of May following; as Maitland, from Stowe, informs us in his History, Vol. I. p. 217. There were then only three lottery-offices in London. The proposals for this lottery were published

Vol. X. Part I.

in the years 1567 and 1568. It was at first intended to have been drawn at the house of Mr Dericke, her majesty's servant (*i. e.* her jeweller), but was afterwards drawn as above mentioned.

Dr Rawlinson showed the Antiquary Society, 1748, "A proposal for a very rich lottery, general without any blanks, containing a great number of good prizes, as well of ready money as of plate and certain sorts of merchandizes, having been valued and prized by the commandment of the queen's most excellent majesty's order, to the extent that such commodities as may chance to arise thereof after the charges borne may be converted towards the reparations of the havens and strength of the realm, and towards such other public good works. The number of lots shall be four hundred thousand, and no more; and every lot shall be the sum of tenne shillings sterling, and no more. To be filled by the seal of St Bartholomew. The shew of prizes are to be seen in Cheapside, at the sign of the Queen's Armes, the house of Mr Dericke, goldsmith, servant to the queen. Some other orders about it in 1567-8. Printed by Hen. Bynneyman."

"In the year 1612, king James, in special favour for the present plantation of English colonies in Virginia, granted a lottery, to be held at the west end of St Paul's; whereof one Thomas Sharplys, a taylor of London, had the chief prize, which was 4000 crowns in fair plate," Baker's Chronicle.

In the reign of queen Anne, it was thought necessary to suppress lotteries, as nuisances to the public. Since that time, however, they have been licensed by an act of parliament, under various regulations. The act passed in 1778 restrains any person from keeping an office for the sale of tickets, shares, or chances, or for buying, selling, insuring, or registering, without a licence; for which licence each office-keeper must pay 50l. to continue in force for one year, and the produce to be applied towards defraying the expences of the lottery. And no person is allowed to sell any share or chance less than a sixteenth, on the penalty of 50l. All tickets divided into shares or chances are to be deposited in an office, to be established in London by the commissioners of the treasury, who are to appoint a person to conduct the business thereof; and all shares are to be stamped by the said officer, who is to give a receipt for every ticket deposited with him. The numbers of all tickets so deposited are to be entered in a book, with the names of the owners, and the number of shares into which they are divided; and twopence for each share is to be paid to the officer on depositing such tickets, who is therewith to pay all expences incident to the office. All tickets deposited in the office are to remain there three days after the drawing. And any person keeping an office, or selling shares, or who shall publish any scheme for receiving moneys in consideration of any interest to be granted in any ticket in the said lottery, &c. without being in possession of such ticket, shall forfeit 500l. and suffer three months imprisonment. And no business is to be transacted at any of the offices after eight in the evening, except on the evening of the Saturday preceding the drawing. No person is to keep any office for the sale of tickets, &c. in Oxford or Cambridge, on penalty of 20l. Before this regulating statute took place, there were upwards of 400 lottery offices in

Lotus.

and about London only; but the whole number afterwards, for all Britain, as appeared by the list published by authority, amounted to no more than 51.

LOTUS, or BIRD'S-FOOT TREFOIL, in botany: A genus of the decandria order, belonging to the diadelphia class of plants; and in the natural method ranking under the 32d order, *Papilionacea*. The legumen is cylindrical, and very erect; the alæ closing upwards longitudinally; the calyx is tubulated. There are many species, but only five or six are usually cultivated in our gardens. 1. The tetragonolobus, or winged pea, hath trailing, slender, branchy stalks, about a foot long, garnished with trifoliate oval leaves; and, from the axillas of the branches, large, papilionaceous red flowers, one on each footstalk; succeeded by tetragonous solitary pods, having a membranous wing or lobe, running longitudinally at each corner. It flowers in June and July, and the seeds ripen in autumn. 2. The creticus, or Cretan silvery lotus, hath a slender under shrubby stalk, rising by support three or four feet high, ornamented with trifoliate, bright, silvery leaves; and branches terminated by several yellow flowers succeeded by subternate pods. 3. The Jacobæus, or lotus of St James's island, hath upright herbaceous stalks branching two or three feet high, and, from the upper part of the branches, long slender footstalks, terminated each by three or five yellowish purple flowers, appearing most part of the summer and autumn, and succeeded by subternate pods filled with plenty of seeds. 4. The hirsutus, or hairy Italian lotus, hath upright hairy stalks branching a yard high; and terminated by heads of whitish hoary-cupped flowers appearing in June, which are succeeded by oval pods full of seed, which ripens in autumn. 5. The dorycnium, white Austrian lotus, or shrub-trefoil of Montpellier, has under shrubby smooth stalks, branching three or four feet high, and the branches terminated by aphyllous heads of small white flowers appearing in June, succeeded by short pods. 6. The edulis, sends forth several trailing stalks about a foot long, furnished at their joints with trifoliate, roundish, smooth leaves, having oval stipule. The flowers come singly from the sides of the stalks, on long peduncles, with three oval floral leaves, the length of the flower: the latter is small, yellow; and is succeeded, by a thick arched pod, having a deep furrow on its outside.

Cultures, &c. The first species is a hardy annual, and is easily raised from seed sown any time from the month of February to May; the plants requiring no other culture than to be kept free from weeds. It was formerly cultivated as an esculent; for its young green feed-pods may be dressed and eat like peas, or in the manner of kidney-beans. The other species may be propagated either by seeds or cuttings, but require to be kept in pots in the green-house during the winter-season. — The sixth species is an annual, and a native of several parts of Italy, where the inhabitants eat the young pods as we do kidney beans. The green pods of the first species were formerly gathered in this country, and dressed in the manner of kidney beans, and are used

to still in some of the northern counties of England; but they are coarse, and not very agreeable to such as have been accustomed to feed upon better fare.

Lotus of Homer. See DIOSPYROS.

Egyptian Lotus. See NYMPHÆA.

Libyan Lotus. See RHAMNUS.

LOVAGE, in botany. See LIGUSTICUM.

LOVE, in a large sense of the word, denotes all those affections of the pleasing kind which objects and incidents raise in us: thus we are said to *love* not only intelligent agents of morally good dispositions, but also sensual pleasures, riches, and honours. But

Love, in its usual and more appropriate signification, may be defined, "that affection which, being compounded of animal desire, esteem, and benevolence, becomes the bond of attachment and union between individuals of the different sexes; and makes them feel in the society of each other a species of happiness which they experience no where else." We call it an *affection* rather than a *passion*, because it involves a desire of the happiness of its object: And that its constituent parts are those which have been just enumerated, we shall first endeavour to prove, and then proceed to trace its rise and progress from a selfish appetite to a generous sentiment

Animal desire is the actual energy of the sensual appetite: and that it is an essential part of the complex affection, which is properly called *love*, is apparent from this consideration, that though a man may have sentiments of esteem and benevolence towards women who are both old and ugly, he never supposes himself to be in love of any woman, to whom he feels not the sensual appetite to have a stronger tendency than to other individuals of her sex. On the other hand, that animal desire *alone* cannot be called the affection of love is evident; because he who gratifies such a desire without esteeming its object, and wishing to communicate at the same time that he receives enjoyment, loves not the woman, but himself. Mere animal desire has nothing in view but the species and the sex of its object; and before it make a selection, it must be combined with sentiments very different from itself. The first sentiment with which it is combined, and by which a man is induced to prefer one woman to another, seems to be that by which we are delighted with gracefulness of person, regularity of features, and beauty of complexion. It is not indeed to be denied that there is something irresistible in female beauty. The most severe will not pretend, that they do not feel an immediate prepossession in favour of a handsome woman; but this prepossession, even when combined with animal desire, does not constitute the whole of that affection which is called *love*. Savages feel the influence of the sensual appetite, and it is extremely probable that they have some ideas of beauty; but among savages the affection of love is seldom felt. Even among the lower orders in civil society it seems to be a very gross passion, and to have in it more of the selfishness of appetite than of the generosity of esteem. To these observations many exceptions will no doubt be found (A): but

Love.

(A) Such as the negroes whose story is so pathetically told by Addison in N^o 215 of the *Spectator*; the two lovers who were killed by lightning at Staunton Harcourt, August 9th 1718, (*see Pope's Letters*); and many others which will occur to every reader.

Love. but we speak of savages in general, and of the great body of the labouring poor, who in the choice of their mates do not study—who indeed are incapable of studying, that rectitude of mind and those delicacies of sentiment, without which neither man nor woman can deserve to be esteemed.

In the savage state, and even in the first stages of refinement, the bond of union between the sexes seems to consist of nothing more than mere animal desire and instinctive tenderness for their infant progeny. The former impels them to unite for the propagation of the species; and the latter preserves the union till the children, who are the fruit of it, be able to provide for their own subsistence. That in such unions, whether casual or permanent, there is no mutual esteem and benevolence, is apparent from the state of subjection in which women are held in rude and uncultivated nations, as well as from the manner in which marriages are in such nations contracted.

Sweetness of temper, a capital article with us in the female character, displays itself externally in mild looks and gentle manners, and is the first and perhaps the most powerful inducement to love in a cultivated mind. "But such graces (says an ingenious writer*) are scarce discernible in a female savage; and even in the most polished woman would not be perceived by a male savage. Among savages, strength and boldness are the only valuable qualities. In these, females are miserably deficient; for which reason they are contemned by the males as beings of an inferior order. The North American tribes glory in idleness: the drudgery of labour degrades a man in their opinion, and is proper for women only. To join young persons in marriage is accordingly the business of the parents; and it would be unpardonable meanness in the bridegroom to show any fondness for the bride. In Guiana a woman never eats with her husband, but after every meal attends him with water for washing; and in the Caribbee islands she is not permitted to eat even in the presence of her husband. Dampier observes in general, that among all the wild nations with which he was acquainted, the women carry the burdens, while the men walk before and carry nothing but their arms; and that women even of the highest rank are not better treated. In Siberia, and even in Russia, the capital excepted, men till very lately treated their wives in every respect like slaves. It might indeed be thought, that animal desire, were there nothing else, should have raised women to some degree of estimation among men; but male savages, utter strangers to decency and refinement, gratify animal desire with as little ceremony as they do hunger or thirst.

"Hence it was that in the early ages of society a man purchased a woman to be his wife as one purchases an ox or a sheep to be food; and valued her only as

she contributed to his sensual gratification. Instances innumerable might be collected from every nation of which we are acquainted with the early history; but we shall content ourselves with mentioning a few. Abraham bought Rebekah and gave her to his son Isaac for a wife†. Jacob having nothing else to give, served † Gen. xxi. Laban 14 years for two wives†. To David, demanding Saul's daughter in marriage, it was said, "The king desireth not any dowry, but an hundred foreskins of the Philistines†." In the Iliad Agamemnon offers † 1 Sam. his daughter to Achilles for a wife, and says that he xviii. 28. would not demand for her any price §. By the laws § Lib. ix. of Ethelbert king of England, a man who committed adultery with his neighbour's wife was obliged to pay the husband a fine, and to buy him another wife. || But it is needless to multiply instances; the practice has prevailed universally among nations emerging from the savage state, or in the rudest stage of society: and wherever it prevailed, men could not possibly have for the fair sex any of that tender regard and esteem which constitute so essential a part of the complex affection of love.

Accordingly we find the magnanimous Achilles an absolute stranger to that generous affection, though his heart was susceptible of the warmest and purest friendship. His attachment to Patroclus was so heroically disinterested, that he willingly sacrificed his own life to revenge the death of his friend; but when Agamemnon threatened to rob him of his favourite female captive, though he felt the insult offered to his pride, he never spoke of the woman but as a slave whom he was concerned to preserve in point of honour, and as a testimony of his glory. Hence it is that we never hear him mention her but as his spoil, the reward of war, or the gift which the Grecians gave him.

"And dar'st thou threat to snatch my prize away,
"Due to the deeds of many a dreadful day?
"A prize as small, O tyrant! match'd with thine,
"As thy own actions if compar'd with mine.
"Thine in each conquest is the wealthy prey,
"Tho' mine the sweat and danger of the day.
"Some trivial present to my ships I bear,
"Or barren praises pay the wounds of war."

And again, after upbraiding the general with his tyranny and want of regard to merit, he adds, with the greatest indifference as to the charms of the woman,

"Seize on Briseis, whom the Grecians doom'd
"My prize of war, yet tamely give up!
"And seize secure, no more Achilles draws
"His conquering sword in any woman's cause.
"The gods command me to forgive the pain;
"But let this first invasion be the last:
"For know, thy blood, when next thou dar'st invade,
"Shall stream in vengeance on my reeking blade."

Pope has made the language of this rough warrior less inconsistent with the peculiar resentment natural to an injured lover than it is in the original (a); but from the

P p z the

(a) The original passages are :

Και δὴ μοι γέρας αἶψας ἀπαρτίσθαι στείλεις,
Εἴ μοι πόλιν ἔμελλεν, δόλον δὲ μοι νῆς Ἀχαιοῖν.
Οὐ μὲν τοὶ πόλιν ἔγω γέρας, σπέντο Ἀχαιοὶ
Τρώων ὑπερσφον ὑπερσφον ὑπὸ πλοῦτον.
Ἀλλὰ το μὲν πλοῦτον πολέμοιοις πόλιν οἶον
Στείλει μοι δῖος ἄταρ νηὶ πόλιν δαίμονος ἐκείνου,
Σοὶ το γέρας ποῦ μείζον, ἔγω δ' ὄλγιστον τί φίλον τέ
Ἐρχομαι ἔγω ἐπὶ νῆας ὑπὸ πλοῦτον πολέμοιοις.

Iliad, Lib. I.

And, Ἀλλὰ δὲ τοι γέρας, σὺ δ' ἐνὶ φρεσὶ βάλλεις σπέν
Χίρην μοι νῆαυτι γέρας μακροτέρην, ἵππικα κούρην,
Οὐτε σοι, σὺ γὰρ ἄλλω, ἐγὼ δὲ φησὶν ἐπὶ δόλῳ.
Τὸν δ' Ἀχαιοί, ἃ μοι ἐστὶ νῆαυτι πλοῦτον ἰσχυρὴν,
Τὸν οὐκ αὖ το γέρας αἶψας ἀπαρτίσθαι στείλει.
Εἰ δ' ἄρτι μοι, χίρην, ἡν ὑπομένω μοι πόλιν
Ἄψα το αἶψα χίρην ἰσχυρὴν ὑπὸ πλοῦτον.

In this latter passage the hero says expressly, "I will not fight with you or with any other man for the sake of a girl; you shall not rob me of any other part of my property;" which is surely the language of a man to whose heart love must have been an utter stranger.

Love.

Gen. xxi.

Gen. xxix.

1 Sam.

xviii. 28.

Lib. ix.

Sec. 31.

* Sketches of
the History
of Man.

the last quoted passage, even as translated by him, it is apparent that Achilles would have been equally hurt had Agamemnon threatened to deprive him of any other part of his plunder. Accordingly he yields up Briseis, not in grief for a mistress whom he loses, but in fullness for an injury that is done him. Nor let it be imagined, that this coldness proceeded from the pride of the hero, which would not permit him to acknowledge his love of a captive. With the generous affection of love captives and princesses were equally incapable of inspiring him. He repeatedly affirmed indeed that he delighted in his fair Lyrnessian slave, but it was only as an instrument of sensual gratification; for as to every thing else in a woman, he was so totally indifferent, that he declared he would not, when he should be disposed to marry, give himself the trouble to make a choice, but leave the whole matter to his father.

"If heav'n restore me to my realms with life,

"The rev'rend Pelus shall elect my wife."

Even Agamemnon, of whom Pope and Madam Dacier think more favourably as a lover, speaks the very same language when mentioning his favourite captive Chryseis. In his furious debate with Achilles he calls her indeed

"A maid, unmatch'd in manners as in face,

"Skill'd in each art, and crown'd with ev'ry grace."

And adds,

"Not half so dear were Glytemnestra's charms,

"When first her blooming beauties blest my arms."

But this was said merely to enhance the value of the prize, which for the public good he was about to resign; for that she was dear to him only as ministering to his pleasure, is past dispute from the language which he had previously held with her father, as well as from his requiring grateful Greece to pay a just equivalent, and to repair his *private loss*. A man who really loved would have thought nothing an equivalent for the object of his love; much less would he have insinuated to her father a possibility of his dismissing from his embrace a woman whom he esteemed, when time should have robbed her of every youthful grace.

Since, then, it is so apparent, that in the heroic age of Greece even princes and kings were strangers to the generous affection of love, it needs not occasion much surprise that the same affection has very little influence upon mankind in the lowest ranks of the most polished societies of modern Europe. That this is actually the case, that among the generality of uneducated men and women there is no other bond of attachment than the sensual appetite, every year furnishes multiplied proofs. We daily see youths, rejected by their mistresses, paying their addresses without delay to girls who, in looks, temper, and disposition, are diametrically opposite to those whom so lately they pretended to love: We daily see maidens, slighted by their lovers, receiving the addresses of men, who, in nothing but their sex, resemble those to whom a week before they wished to be married: and we believe it is not very uncommon to find a girl entertaining several lovers together, that if one or more of them should prove false, she may still have a chance not to be totally deserted. Did esteem and benevolence, placed on manners and character, constitute any part of vulgar love, these people would act very differently; for they would

find it impossible to change their lovers and their mistresses with the same ease that they change their cloaths.

To this account of love, as it appears in savage nations, some one may perhaps oppose the paintings of the softer passion in the poems of Ossian. That bard describes the female character as commanding respect and esteem, and the Caledonian heroes as cherishing for their mistresses a flame so pure and elevated as never was surpassed, and has seldom been equalled, in those ages which we commonly call most enlightened. This is indeed true: and it is one of the many reasons which have induced Johnson and others to pronounce the whole a modern fiction. Into that debate we do not enter. We may admit the authenticity of the poems, without acknowledging that they furnish any exception to our general theory. They furnish indeed in the manners which they describe a wonderful anomaly in the general history of man. All other nations of which we read were in the hunter-state savage and cruel. The Caledonians, as exhibited by Ossian, are gentle and magnanimous. The heroes of Homer fought for plunder, and felt no clemency for a vanquished foe. The heroes of Ossian fought for fame; and when their enemies were subdued, they took them to their bosoms. The first of Greeks committed a mean insult on the dead body of the first of Trojans. Among the Caledonians insults offered to the dead, as well as cruelty to the living, were condemned as infamous. The heroes of Ossian appear in no instance as savages. How they came to be polished and refined before they were acquainted with agriculture and the most useful arts of life, it is not our business to enquire; but since they unquestionably were so, their treatment of the female sex, instead of opposing, confirms our theory; for we never conceived rich cloaths, superb houses, highly-dressed food, or even the knowledge of foreign tongues, to be necessary to the acquisition of a generous sentiment. Luxury indeed appears to be as inimical to love as barbarism: and we believe, that in modern nations the tender and exalted affection which deserves that name is as little known among the highest orders of life as among the lowest. Perhaps the Caledonian ladies of Ossian resembled in their manners the German ladies of Tacitus, who accompanied their husbands to the chase, fought by their sides in battle, and partook with them of every danger. If so, they could not fail to be respected by a race of heroes among whom courage took place of all other virtues: and this single circumstance, from whatever cause it might proceed, will sufficiently account for the estimation of the female character among the ancient Germans and Caledonians, so different from that in which it has been held in almost every other barbarous nation.

But if among savages and the vulgar, love be unknown, it cannot possibly be an instinctive affection: and therefore it may be asked, How it gets possession of the human heart; and by what means we can judge whether in any particular instance it be real or imaginary? These questions are of importance, and deserve to be fully answered; though many circumstances conspire to render it no easy task to give to them such answers as shall be perfectly satisfactory. Love can subsist only between individuals of the different sexes. A man can hardly love two women at the same time; and

Love.

and we believe that a woman is still *left* capable of *loving at once more than one man*. Love, therefore, has a natural tendency to make men and women pair, or, in other words, it is the source of marriage: but in polished society, where alone this affection has any place, so many things besides mutual attachment are necessary to make the married life comfortable, that we rarely see young persons uniting from the impulse of love, and have therefore but few opportunities of tracing the rise, progress, and consequences of the affection. We shall, however, throw together such reflections as have occurred to us on the subject, not without indulging a hope, that they may be useful to the younger part of our readers when forming the most important connection in life.

We have said, that the perception of beauty, combined with animal desire, is the first inducement which a man can have to prefer one woman to another. It may be added, that elegance of figure, a placid masculine countenance, with a person which indicates strength and agility, are the qualities which first tend to attach any woman to a particular man. Beauty has been defined †, “That particular form, which is the most common of all particular forms to be met with in the same species of beings.” Let us apply this definition to our own species, and try, by means of it, to ascertain what constitutes the beauty of the human face. It is evident, that of countenances we find a number almost infinite of different forms, of which forms one only constitutes beauty, whilst the rest, however numerous, constitute what is *not* beauty, but *deformity*, or *ugliness*. To an attentive observer, however, it is evident, that of the numerous particular forms of *ugliness*, there is not one which includes so many faces as are formed after that particular cast which constitutes *beauty*. Every particular species of the animal as well as of the vegetable creation, may be said to have a fixed or determinate form, to which, as to a centre, nature is continually inclining. Or it may be compared to pendulums vibrating in different directions over one central point; and as they *all* cross the centre, though only one passes through any *other point*; so it will be found that *perfect beauty* is oftener produced by nature than deformity: we do not mean then deformity in *general*, but than any *one kind and degree* of deformity. To infringe in a particular part of a human feature: the line which forms the ridge of the nose is deemed beautiful when it is *straight*; but this is likewise the *central form*, which is oftener found than any *one particular degree* of *concave*, *convex*, or any *other* irregular form that shall be proposed. As we are then more accustomed to beauty than deformity, we may conclude that to be the reason why we approve and admire it, just as we approve and admire fashions of dress for no other reason than that we are used to them. The same thing may be said of colour as of form; it is custom alone which determines our preference of the colour of the *Europeans* to that of the *Ethiopians*, and which makes them prefer their own colour to ours; so that though habit and custom cannot be the cause of beauty (see *BEAUTY*), they are certainly the cause of our liking it.

That we *do like* it cannot be denied. Every one is conscious of a pleasing emotion when contemplating beauty either in man or woman; and when that plea-

sure is combined with the gratification of the sensual appetite, it is obvious that the sum of enjoyment must be greatly increased. The perception of beauty, therefore, necessarily directs the energy of the sensual appetite to a *particular* object; but still this combination is a mere selfish feeling, which regards its object only as the *best* of many similar instruments of pleasure. Before it can deserve the name of *love*, it must be combined with esteem, which is never belittled but upon moral character and internal worth; for let a woman be ever so beautiful, and of course ever so desirable as an instrument of sensual gratification, if she be not possessed of the virtues and dispositions which are peculiar to her sex, she will inspire no man with a generous affection. With regard to the outlines, indeed, whether of internal disposition or of external form, men and women are the same; but nature, intending them for mates, has given them dispositions, which, though concordant, are, however, different, so as to produce together delicious harmony. “The man, more robust, is fitted for severe labour, and for field exercises; the woman, more delicate, is fitted for sedentary occupations, and particularly for nursing children. The man, bold and vigorous, is qualified for being a protector ‡; the woman, delicate and timid, † *Seesteele* of *Min.* requires protection. Hence it is, that a man never admires a woman for possessing bodily strength or personal courage; and women always despise men who are totally destitute of these qualities. The man, as a protector, is directed by nature to govern; the woman, conscious of inferiority, is disposed to obey. Their intellectual powers correspond to the destination of nature. Men have penetration and solid judgment to fit them for governing; women have sufficient understanding to make a decent figure under good government: a greater proportion would excite dangerous rivalry between the sexes, which nature has avoided by giving them different talents. Women have more imagination and sensibility than men, which make all their enjoyments more exquisite; at the same time that they are better qualified to communicate enjoyment. Add another capital difference of disposition: the gentle and insinuating manners of the female sex tend to soften the roughness of the other sex; and wherever women are indulged with any freedom, they polish sooner than men.

“There are not the only particulars that distinguish the sexes. With respect to the ultimate end of love, it is the privilege of the male, as superior and protector, to make a choice: the female, preferred, has no privilege but barely to consent or to refuse. Whether this distinction be the immediate result of the originally different dispositions of the sexes, or only the effect of associations inevitably formed, may be questioned; but among all nations it is the practice for men to court, and for women to be courted: and were the most beautiful woman on earth to invert this practice, she would forfeit the esteem, however by her external grace she might excite the desire, of the man whom she addressed. The great moral virtues which may be comprehended under the general term *integrity*, are all absolutely necessary to make either men or women estimable; but to procure esteem to the female character, the modesty peculiar to their sex is a very essential circumstance. Nature hath provided them with it as a defence against the artful solicitations of the other sex.

Love.

† By Peter Buffier in his *First Truths*, and Sir Joshua Reynolds in the *Adler*.

‡ See *Seesteele* of *Min.*

sex before marriage, and also as a support of conjugal fidelity."

A woman, therefore, whose dispositions are gentle, delicate, and rather timid than bold, who is possessed of a large share of sensibility and modesty, and whose manners are soft and insinuating, mult, upon moral principles (see MORAL PHILOSOPHY), command the esteem and benevolence of every individual of the other sex who is possessed of sound understanding; but if her person be deformed, or not such as to excite some degree of animal desire, she will attract no man's love. In like manner, a man whose moral character is good, whose understanding is acute, and whose conversation is instructive, mult command the esteem of every sensible and virtuous woman; but if his figure be disagreeable, his manners unpolished, his habits slovenly, and above all, if he be deficient in personal courage, he will hardly excite desire in the female breast. It is only when the qualities which command esteem are, in the same person, united with those which excite desire, that the individual so accomplished can be an object of love to one of the other sex; but when these qualities are thus united, each of them increases the other in the imagination of the lover. The beauty of his mistress gives her, in his apprehension, a greater share of gentleness, modesty, and every thing which adorns the female character, than perhaps the really possesses; whilst his persuasion of her internal worth makes him, on the other hand, apprehend her beauty to be absolutely unrivalled.

To this theory an objection readily offers itself, which it is incumbent upon us to obviate. Men and women sometimes fall in love at first sight, and very often before they have opportunities of forming a just estimate of each other's moral character: How is this circumstance to be reconciled with the progressive generation of love? We answer, By an association of ideas which is formed upon principles of physiognomy. Every passion and habitual disposition of mind gives a particular cast to the countenance, and is apt to discover itself in some feature of the face. This we learn by experience; and in time, without any effort of our own, the idea of each particular cast of countenance comes to be so closely associated in our minds with the internal disposition which it indicates, that the one can never afterwards be presented to our view without instantly suggesting the other to the imagination. (See METAPHYSICS and PHYSIOGNOMY). Hence it is that every man, who has been accustomed to make observations, naturally forms to himself, from the features and lineaments of a stranger's face, some opinion of his character and fortune. We are no sooner presented to a person for the first time, than we are immediately impressed with the idea of a proud, a reserved, an affable, or a good-natured man; and upon our going into a company of absolute strangers, our benevolence or aversion, our awe or contempt, rises instantly towards particular persons, before we have heard them speak a word, or know so much as their names or designations. The same thing happens when we are presented to the fair sex. If a woman, seen for the first time, have that particular cast of countenance, and that expression of features, to which we have associated notions of *gentleness*, *modesty*, and other female virtues, she instantly commands our esteem;

and if she have likewise so much *beauty* as to make her an object of particular *desire*, esteem and desire become suddenly combined; and that combination constitutes the affection of love. Such, too, is the nature of all mental associations, that each part of which they are composed adds strength and vividness to the other parts; so that, in the present instance, desire makes us imagine virtues in the woman which her countenance perhaps does not indicate; and the virtues which are there actually visible, make us apprehend her beauty as more perfect than it is.

The affection thus generated is more or less pure, and will be more or less permanent, according as the one or the other part of which it is compounded predominates. "Where desire of possession || prevails over || our esteem of the person and merits of the definable object, love loses its benevolent character: the appetite for gratification becomes ungovernable, and tends violently to its end, regardless of the misery that mult follow. In that state love is no longer a sweet agreeable affection; it becomes a selfish, painful passion, which, like hunger and thirst, produceth no happiness but in the instant of fruition; and when frustration is over, disgust and aversion generally succeed to desire. On the other hand, where esteem, founded on a virtuous character and gentle manners, prevails over animal desire, the lover would not for the world gratify his appetite at the expence of his mistress's honour or peace of mind. He wishes, indeed, for enjoyment; and to him enjoyment is more exquisite than to the mere sensual lover, because it unites sentiment with the gratification of sense; at the same time that, so far from being succeeded by disgust or aversion, it increases his benevolence to the woman, whose character and manners he esteems, and who has contributed so much to his pleasure. Benevolence to an individual, having a general end, admits of acts without number, and is seldom fully accomplished. Hence mutual love, which is composed chiefly of esteem and benevolence, can hardly be of a shorter duration than its objects. Frequent enjoyment endears such lovers to each other, and makes constancy a pleasure; and when the days of sensual enjoyment are over, esteem and benevolence will remain in the mind, making sweet, even in old age, the society of that pair, in whom are collected the affections of husband, wife, lover, friend, the tenderest affections of human nature."

From the whole of this investigation, we think it appears, that the affection between the sexes which deserves the name of *love*, is inseparably connected with virtue and delicacy; that a man of loose morals cannot be a faithful or a generous lover; that in the breast of him who has ranged from woman to woman for the mere gratification of his sensual appetite, desire mult have effaced all esteem for the female character; and that, therefore, the maxim too generally received, "that a reformed rake makes the best husband," has very seldom a chance to be true. We think it may likewise be inferred, that thousands fancy themselves in love who know not what love is, or how it is generated in the human breast: and therefore we beg leave to advise such of our readers as may imagine themselves to be in that state, to examine their own minds, with a view to discover, whether, if the objects of their love were old or ugly, they would still esteem

Love.

them for the virtues of their character, and the propriety of their manners. This is a question which deserves to be well weighed by the young and the amorous, who, in forming the matrimonial connection, are too often blindly impelled by mere animal desire inflamed by beauty. "It may indeed happen, after the pleasure of gratifying that desire is gone (and if not refined by esteem and benevolence, go it must with a swift pace), that a new bond of attachment may be formed upon more dignified and more lasting principles; but this is a dangerous experiment. Even supposing good sense, good temper, and internal worth of every sort, yet a new attachment upon such qualifications is rarely formed; because it commonly, or rather *always*, happens, that such qualifications, the only solid foundation of an indissoluble connection, if they did not originally make esteem predominate over animal desire, are afterwards rendered altogether invisible by satiety of enjoyment creating disgust."

Elements
of Criticism.

Love, in medicine. The symptoms produced by this passion as a disease, according to medical writers, are as follow: The eye-lids often twinkle; the eyes are hollow, and yet appear as if full with pleasure: the pulse is not peculiar to the passion, but the same with that which attends solicitude and care. When the object of this affection is thought of, particularly if the idea is sudden, the spirits are confused, the pulse changes, and its force and time are very variable: in some instances, the person is sad and watchful; in others, the person, not being conscious of his state, pines away, is slothful, and regardless of food; though the wife, when they find themselves in love, seek pleasant company and active entertainments. As the force of love prevails, sighs grow deeper; a tremor affects the heart and pulse; the countenance is alternately pale and red; the voice is suppressed in the fauces; the eyes grow dim; cold sweats break out; sleep absents itself, at least until the morning; the secretions become disturbed; and a loss of appetite, a hectic fever, melancholy, or perhaps madness, if not death, constitutes the sad catastrophe. On this subject the curious may consult *Egineta*, lib. iii. cap. 17. *Oribat.* Synop. lib. viii. cap. 9. or a treatise professedly written on love, as it is a distemper, by James Ferrard, Oxford, printed 1640.

The manner of the Greeks and Romans were similar to each other in the affairs of love. They generally made a discovery of their passion, by writing upon trees, walls, doors, &c. the name of their beloved. They usually decorated the door of their dulcinea with flowers and garlands, made libations of wine before their houses, sprinkling the posts with the same liquor, as if the object of their affection was a real goddess. For a man's garland to be untied, and for a woman to compose a garland, were held to be indubitable indications of their love.

When their love was without success, they used several arts to excite affection in the object of their desire. They had recourse to enchantresses, of whom the Thessalian were in the highest estimation.—The means made use of were most commonly philtres or love potions, the operation of which was violent and dangerous, and frequently deprived such as drank them of their reason. Some of the most remarkable ingre-

dients of which they were composed were these: the hippomanes, the jynx, insects bred from putrefaction, the fish remora, the lizard, brains of a calf, the hairs on the tip of a wolf's tail, his secret parts, the bones of the left side of a toad eaten with ants, the blood of doves, bones of snakes, feathers of screech-owls, twisted cords of wool in which a person had hanged himself, rags, torches, reliques, a net of swallows buried and famished in the earth, bones snatched from hungry bitches, the marrow of a boy famished in the midst of plenty, dried human liver; to these may be added several herbs growing out of putrid substances. Such were the ingredients that entered into the composition of that infernal draught a *love potion*.

But, besides the philtres, various other arts were used to excite love, in which the application of certain substances was to have a magical influence on the person against whom they levelled their skill. A hyena's udder worn under the left arm, they fancied would draw the affections of whatever woman they fixed their eyes upon. That species of olives called *πύρα*, and barley-bran made up into a paste, and thrown into the fire, they thought would excite the flame of love. Flour was used with the same intention. Burning laurel, and melting wax, were supposed to have the like effect. When one heart was to be hardened, and another mollified, clay and wax were exposed to the same fire together. Images of wax were frequently used, representing the persons on whom they wished to make an impression; and whatever was done to the substitute of wax, they imagined was felt by the person represented. Enchanted medicaments were often sprinkled on some part of the house where the person resided. Love-pledges were supposed to be of singular use and efficacy: these they placed under their threshold, to preserve the affections of the owner from wandering. Love-knots were of singular power, and the number three was particularly observed in all they did. But no good effect was expected, if the use of these things was not attended with charms or magical verses and forms of words. See *Magic*.

Having mentioned their arts of exciting love, it may not be amiss to take notice, that the ancients imagined, that love excited by magic might be allayed by more powerful spells and medicaments, or by applying to demons more powerful than those who had been concerned in raising that passion. But love inspired without magic had no cure; Apollo himself could find no remedy, but cried out

Hei mihi quod nullis amor est medicabilis herbis.

The antidotes against love were generally *agnus castus*, which has the power of weakening the generative faculty; sprinkling the dust in which a male had rolled herself; tying toads in the hide of a beast newly slain; applying amulets of minerals or herbs, which were supposed of great efficacy in other cases; and invoking the assistance of the infernal deities. Another cure for love was bathing in the waters of the river Sclemnus; to which we may add the lover's leap, or jumping down from the Leucadian promontory.

Love-Apple. See *Solanum*.

LOVENTINUM, or LUENTINUM, (anc. geog.) a town of the Demeta in Britain, near the mouth of the Tuerobis or Tyvi. Supposed to have been afterwards

Love,
Loventinum.

Loughbo-rough wards swallowed up by an earthquake, and to have flood where is now the lake called *Lin Suatan* in Brecknockshire.

Lough-neach. LOUGHBOROUGH, a town of Leicestershire in England, 110 miles from London. It is the second town in the county, and was in the Saxons time a royal village. Its market is on Thursday; and its fairs are on April 25th, May 28th, August 1st, and November 2d. It has a large church, and a free school; besides a charity school for 80 boys and another for 20 girls. It has been very much reduced by fires; but is still a very agreeable town, with rich meadow-ground, on the Fosse, which runs here almost parallel with the river Soar. The new canal has made the coal-trade here very extensive.

LOUGHBRICKLAND, a fair and post town of Ireland, situated in the county of Down, and province of Ulster, 58 miles from Dublin. The name signifies the lake of the *speckled trout*; and it was so called from a lake near it, which abounds with those fish. It consists of one broad street, at the end of which is the parish-church, said to have been built by Dr Taylor when bishop of Dromore, soon after the Restoration. The linen manufacture is carried on here very extensively; and the town is a great thoroughfare, the turnpike road from Dublin to Belfast passing through a red bog near it. The fairs are five in the year.

LOUGH-DERG, anciently *Dergabhan*, i. e. "the river of the woody morafs," from a river which issues out of this lake. This lough is situated in the county of Donegal and province of Ulster in Ireland, and is famous for having in it the island that contains St Patrick's purgatory, which is a narrow little cell, hewn out of the solid rock, in which a man could scarce stand upright.—There is also a lake of this name situated between the counties of Galway and Tipperary.

LOUGH-NEACH, a loch or lake of Ireland, situated in the counties of Armagh, Down, Derry, and Antrim, and province of Ulster. It is the largest in Europe, those of Ladoga and Onega in Russia, and that of Geneva in Switzerland, excepted; being 20 miles long and 15 broad. The area of this lake is computed to be 100,000 acres. It is remarkable for a healing virtue; and likewise for petrifying wood, which is not only found in the water but in the adjacent soil at a considerable depth. On its shores several beautiful gems have been discovered. Its ancient name was *Loch-neacha* or *Loch-Neach*, from *loch*, "a lake," and *Neach*, "wonderful, divine, or eminent." Its petrifying powers are not instantaneous, as several of the ancients have supposed, but require a long series of ages to bring them to perfection, and appear to be occasioned by a fine mud or sand, which insinuates itself into the pores of the wood, and which in process of time becomes hard like stone. On the borders of this lake is Shane's castle, the elegant seat of the right honourable John O'Neil. Dr Smyth seems to doubt whether the healing quality in this lake is not to be confined to one side of it, called the *fishing-bank*; and he informs us, that this virtue was discovered in the reign of Charles II. in the infancy of the son of one Mr Cunningham, who had an *evil* which run on him in eight or ten places; and notwithstanding all applications seemed incurable, at length

he was perfectly healed, after bathing in this lough about eight days. Hence that writer gives us another derivation of the name *Lochneach*, which (he says) seems to hint at this quality; *Neagh* or *Neat*, in Irish, signifying a sore or ulcer," which might not improbably be corrupted into *Neagh*; Hence he apprehends, this lake was remarked at a much earlier period for its healing property. As to its petrifying power, it is mentioned by Nennius, a writer of the 9th century, who says, "Eit aliud stagnum quod facit ligna durescere in lapides. Homines autem findunt ligna, et postquam formaverunt, projiciunt in stagnum, et manent in eo usque ad caput anni, et in capite anni lapidis invenitur, et vocatur stagnum *Loch-Eebach*." Lough-Neach gives title of baron to the family of *Skeffington*.

LOUGH-STRANGFORD, a lake of Ireland, situated in the county of Down and province of Ulster. It takes its present name from a small port-town called *Strangford*, seated on the west side of the narrow entrance into the sea. It was formerly known by the name of *Lough-Cone* or *Lough-Coyne*. It is a deep bay or inlet of the sea, about 17 miles long and four or five broad; it goes west as far as Downpatrick, and north as far as Comber and Newtown, and by computation covers 25,775 acres, Irish plantation measure. It abounds with excellent fish, particularly smelts; and off the bar there is a periodical herring fishery in or about August. The bar or entrance into this lough is about three miles below Strangford. There is a long rock at the entrance in the middle of the passage, dangerous to strangers on account of the current; yet there is a broad passage on either side, and deep water. The current here is very strong and rapid, running at the rate of six or seven miles an hour. There are but few vessels that go higher up than Strangford. A good many vessels bound up the channel put in here, if the wind is unfavourable to their passage. The islands in this lake are numerous; Doctor Boat enumerates them at 250. But from an actual survey, made at the time Dr Smyth wrote his history of that county, it appears, there are 54 islands small and great, known by particular names, and many others nameless; the contents of these 54 islands added together amount to 974 acres and an half. The great and profitable manufacture carried on in these islands, and the flat stony coasts surrounding the lake, is the burning of sea-weed into kelp, which employs a number of hands, and has been computed to produce to the several proprietors a neat profit of 1200 l. per annum and upwards. Four of the islands here are called *Swan islands*, from the number of swans that frequent them.

LOUIS, or *Knights of St Louis*, the name of a military order in France, instituted by Louis XIV. in 1693. Their colours are of a flame colour, and pass from left to right; the king is their grand master. There are in it eight great crosses, and 24 commanders; the number of knights is not limited. At the time of their institution, the king charged his revenue with a fund of 300,000 livres for the pensions of the commanders and knights.

LOUIS, *Lewis*, *Louis d'or*, or *Lewidore*, a French coin, first struck in 1640, under the reign of Louis XIII. and which has now a considerable currency. See *MONEY-TABLE*.

Louisiana
 Louvain.

LOUISIANA, a country in North-America, bounded on the south by the gulph of Mexico, on the east by the river Mississippi, on the west by New Mexico, and on the north by an unknown country. It extends from the 29th to the 40th degree of north latitude, and from about the 82th to the 96th or 97th degree west longitude from London. The climate of Louisiana varies according to the latitudes. The southern parts are not so hot as those parts of Africa which lie under the same parallel, and the northern parts are colder than the countries of Europe at the same distance from the pole; the causes of which are supposed to be the thick forests which over-run the country, and the great number of rivers; the former preventing the sun from heating the earth, and the latter supplying it with moist vapours; besides the cold winds which come from the north over vast tracts of land. They have bad weather; but it never lasts long, for the rain generally falls in storms and sudden showers; the air is wholesome, the inhabitants healthy, and they who are temperate live to a great old age. The country is extremely well watered; and almost all the rivers that run through it fall into the Mississippi, which discharges itself into the gulph of Florida.

LOUSE, in zoology. See **PEDICULUS** and **LICE**.

LOUSY DISEASE. See **MEDICINE-Index**.

LOUTH, a town of Lincolnshire in England, 156 miles from London. It is a town corporate; and one of the handsomest and gayest in the county, there being in it not only frequent assemblies, concerts, &c. but even masquerades. Here are several handsome houses. From hence there is a canal to the sea at Tilney, about eight miles. Besides a charity school for 40 children, it has a free school founded by Edward VI. with a large church, and a fine steeple, which some think is as high as Grantham spire, which is 288 feet high. Its markets are on Wednesday and Saturday, and its fairs on May 24th, and August 16th.

LOUTH, a county in the eastern part of Ireland, which extends in the form of a bow or half-moon, on the side of the ocean, being much longer than it is broad; it is bounded on the south and south-west by the county of East-Meath, on the north-west by Monaghan, on the north by Armagh, and on the north-east by the bay of Carlingford, which parts it from the county of Down: it is watered by several small rivers which fall into the sea; and its south frontiers are watered by the river Boyne. Its chief towns are Dundalk and Carlingford; unless we include Drogheda, a part whereof is in this county. It is the smallest county in the kingdom; but very fertile and pleasant, and abounding with many remains of antiquities, of which Mr Wright, in his *Louthiana*, has given a very ample description. It contains 111,180 Irish plantation acres, 50 parishes, 5 baronies, and 5 boroughs, and returns 10 members to parliament: it is about 22 miles long and 14 broad.

LOUTH, a town in the above county, having a yearly fair.

LOUVAIN, a city in the Austrian Netherlands, in the province of Brabant, pleasantly seated on the river Dyle, in a plentiful and agreeable country. The walls are about eight or nine miles in circumference; but they include several fields and vineyards. The castle stands

on a high hill, surrounded with fine gardens, and has a charming prospect all over the country: This town contains nine market places, 14 water-mills, 126 streets, 16 stone bridges, and several handsome palaces. The town-house is a venerable old building, adorned with statues on the outside; and the churches are very handsome, particularly the collegiate church of St Peter, but the principal ornament is the university, founded only in 1426 by John IV. duke of Brabant, with the concurrence of Pope Martin V. It contains about 40 colleges, four of which are called *Pedagogia*. There is in the number also an English college of friars-preachers, which owes its establishment to the liberalities of Cardinal Philip Howard, brother to the duke of Norfolk, who, before he was raised to the purple, had been private chaplain to Queen Catherine, consort to Charles II. The Irish have likewise a seminary, erected in part under the care of Eugenius Mattheus, titular archbishop of Dublin, anno 1623, which receives its appointments from the Propaganda at Rome. Besides the above, there are two convents for the Irish, one of Recollets and the other of Dominicans, where divinity and the Mathesis are taught. In the last century the number of scholars exceeded 4000, but in the year 1743 the inhabitants amounted to 12,000, including 2000 students only.—At the beginning of the 14th century, under John III. it flourished considerably in the manufacture of woollen cloth: 400 houses were then occupied by substantial clothiers, who gave employment to an incredible number of weavers, so great it is said, that a bell was rung to prevent any injuries which the children in the street might receive from the crowd and hurry on their returning from work. In 1382, these weavers, however, took up arms, and rebelled against their sovereign Prince Wenceslaus, throwing from the windows of the Town-hall 17 of the aldermen and counsellors, and afterwards proceeded to lay waste great part of Brabant: but being besieged and reduced to great extremities, they submissively implored his clemency: which was granted after the execution of some of the principal ringleaders. The weavers, the chief instigators to this revolt, were banished, the greater part of whom took refuge in England; where they first introduced, or at least augmented very much, the woollen manufacture. The town, by this circumstance, being almost depopulated, the university was established to supply in some measure the loss of the rebellious clothiers. Since that time the manufacture gradually declined, no cloth of any account being made there at present. This impolitic step of the Duke Wenceslaus sent treasures to England, through the hands of those exiled people; an important lesson to governors, that they should deal with great precaution respecting such useful members of the community. Upon the ruins of these looms was formed the cloth manufacture of Limbourg, which is carried on with good advantage to this day. There is yet standing at Louvain part of the old drapers-hall, now converted into four public schools, where lectures in divinity, philosophy, law, and physic, are given, and the public ads are made. Adjoining to the schools is the university library, which altogether compose a large pile of building. Over the door of the chief entrance we read these words, *Sapientia adificavit huius domum*. The principal church is collegiate, dedicated to

Louvain.

Louys,
Low-bell.

St Peter, which had formerly three very large towers with elevated spires, one considerably higher than the two collaterals; these were blown down in the year recorded by this chronogram, *oMula CaDVnt*. From the name of this church the burghers have acquired the nick-name of *Petermen*, whose ancestors having clothed the back by a noble woollen manufacture, the modern *Petermen* now compose an ignoble mixture for the belly, called after them, *Peterman beer*, a sort of whitish muddy ale, which they notwithstanding send in large quantities to all parts of the country, as well as to Holland, by the canals. Louvain was anciently the capital of the province, long before Bruxelles had any claim to that title. E. Long. 4. 40. N. Lat. 51. 12.

LOUYS, or LOUIS, (John), an engraver of considerable eminence, who flourished about the middle of the 16th century. According to Baſan, he was a native of Flanders. He learned the art of engraving from Peter Soutman, at the time that Suyderhoef studied under the same master; and his usual style of engraving bears some resemblance to that of his master's. One of his best prints is, Diana, with her nymphs, reposing after the chase; a middling-sized plate, lengthwise, from Rubens.

LOW-BELL, in birding, a name given to a bell, by means of which they take birds in the night, in open champaign countries, and among stubble, in October. The method is to go out about nine o'clock at night in a still evening, when the air is mild and the fow does not shine. The low-bell should be of a deep and hollow sound, and of such a size that a man may conveniently carry it in one hand. The person who carries it is to make it toll all the way he goes, as nearly as may be, in that manner in which the bell on the neck of a sheep tolls as it goes on and feeds. There must also be a box made like a large lantern, about a foot square, and lined with tin, but with one side open. Two or three great lights are to be set in this; and the box is to be fixed to the person's breast, with the open side forwards, so that the light may be cast forward to a great distance. It will spread as it goes out of the box; and will distinctly show to the person that carries it whatever there is in the large space of ground over which it extends, and consequently all the birds that roost upon the ground. Two persons must follow him who carries the box and bell, one on each side, so as not to be within the reach of the light to show themselves. Each of these is to have a hand-net of about three or four feet square, fastened to a long stick or pole; and on whichever side any bird is seen at roost, the person who is nearest is to lay his net over it, and take it with as little noise as possible. When the net is over the bird, the person who laid it is not to be in a hurry to take the bird, but must stay till he who carries the light is got beyond it, that the motions may not be discovered. The blaze of the light and the noise of the bell terrify and amaze the birds in such a manner that they remain still to be taken; but the people who are about the work must keep the greatest quiet and stillness that may be.

Some people are fond of going on this scheme alone. The person then fixes the light box to his breast and carries the bell in one hand and the net in the other; the net in this case may be somewhat smaller, and the handle shorter. When more than

one are out at a time, it is always proper to carry a gun; as it is no uncommon thing to spy a hare when on this expedition.

LOW (EAST), a town of Cornwall in England, 231 miles from London, in the post-road from Plymouth. It is an ancient borough by precription, made a corporation by charter of queen Elizabeth, consisting of nine burgesses (one of whom is yearly chosen the mayor), a recorder, aldermen, &c.; and the mayor, magistrates, and freemen, who are about 68, choose the members of parliament. This being a manor of the duchy of Cornwall, was settled by king William on lord Somers, and is now held by the corporation at the fee-farm rent of 20s. a-year. It is seated pretty commodiously on a creek of the sea, over which there is a large stone bridge, supported by 15 arches, which leads to *West Low*, standing between two hills. The chief benefit which the inhabitants have is in their fishery. Here is a battery of four guns, and a small chapel. Its market is on Saturday, and it has two fairs in the year.

Low (West), called also *Port-Pigbam*, a town of Cornwall, divided from East Low by a stone bridge of 15 arches over the river Low, from whence both towns receive their name, as the river does from the lowness of its current between its high banks. The corporation, by charter of queen Elizabeth, consists of 12 burgesses, one of whom is annually chosen mayor, and, with the other burgesses, has power to choose a steward. Its members, whom it has sent to parliament ever since the 6th of Edward VI. are elected by the corporation and freemen, who are about 60. There was a chapel of ease here in the reign of Henry VIII. which was afterwards converted into a town-hall; and the town lying in the parish of Taland, the people go thither to church. The market is on Saturday, and fair on April 25. There is a pretty little harbour here; near the mouth of which is a small island called St George's, which abounds with sea-peas. The river here is navigable for vessels of 100 tons.

LOWER (Richard), an eminent English physician in the 17th century, was born in Cornwall, and educated at Westminster-school and Oxford. He entered on the physic line; and practised under Dr Thomas Willis, whom he instructed in some parts of anatomy, especially when the latter was writing his *Cerebri anatome*. He, with Dr Willis, in 1674, discovered the medicinal waters at Ashup in Northamptonshire; which, upon their recommendations, became very much frequented. In 1666 he followed Dr Willis to London; practised physic under him; and became fellow of the royal society, and of the college of physicians. In 1669 he published his *Traictatus de corde*; and, after the death of Dr Willis in 1675, he was esteemed the most eminent physician in London. Upon the breaking out of the Popish plot in 1678, says Mr Wood in his *Athena Oxoniensis*, he clofed with the Whigs, supposing that party would carry all before them; but, being mistaken, he lost his credit and practice. He died in 1691.

LOWERING, among distillers, a term used to express the debasing the strength of any spirituous liquor, by mixing water with it. The standard and marketable price of these liquors is fixed in regard to

Low
Lowering.

Lowth.

a certain strength in them called *proof*; this is that strength which makes them, when shaken in a phial or poured from on high into a glass, retain a froth or crown of bubbles for some time. In this state, spirits consist of about half pure or totally inflammable spirit, and half water; and if any foreign or home spirits are to be exposed to sale, and are found to have that proof wanting, scarce any body will buy it till it has been distilled again and brought to that strength; and if it is above that strength, the proprietor usually adds water to it to bring it down to that standard. See the article *PROOF*.

There is another kind of lowering among the retailers of spirituous liquors to the vulgar, by reducing it under the standard proof. Whoever has the art of doing this without destroying the bubble proof, which is easily done by means of some addition that gives a greater tenacity to the parts of the spirits, will deceive all that judge by this proof alone. In this case, the best way to judge of liquors is by the eye and tongue, and especially by the instrument called *HYDROMETER*.

LOWTH (William), D.D. a learned divine, born at London in 1661, was the son of an apothecary, and took his degrees at Oxford. His eminent worth and learning recommended him to Dr Mew bishop of Winchester, who made him his chaplain, gave him two livings in Hampshire, and conferred on him a prebend in the cathedral of Winchester. He acquired an unusual share of critical learning. Thus situated in life, the labours of Mr Lowth appear to have been strictly confined within the limits of his own province, and applied solely to the peculiar duties of his function; yet, in order that he might acquit himself the better in theology, he had purified his studies with a more general and extensive view. Few were more deeply versed in critical learning; there being scarcely any ancient author, Greek or Latin, profane or ecclesiastical, especially the latter, but what he had read with accuracy, constantly accompanying his reading with critical and philological remarks. Of his collections in this way he was upon all occasions very communicative. Hence his notes on *Clemens Alexandrinus*, which are to be met with in Potter's edition of that father. Hence his remarks on *Josephus*, communicated to Hudson for his edition, and acknowledged in the preface: as also those larger and more numerous annotations on the Ecclesiastical Historians, inserted in *Reading's* edition of them at Cambridge. The author of *Bibliotheca Biblica* was indebted to him for the same kind of assistance. Chandler, late bishop of Durham, while engaged in his "Defence of Christianity, from the Prophecies of the Old Testament, against the Discourse of the Grounds and Reasons of the Christian Religion," and in his "Vindication of the Defence, in answer to The Scheme of Literal Prophecy considered," held a constant correspondence with him, and consulted him upon many difficulties that occurred in the course of that work. The most valuable part of his character was that which least appeared in the eyes of the world, the private and retired part, that of the good Christian and the useful parish-priest. His piety, his diligence, his hospitality and beneficence, rendered his life highly exemplary, and greatly enforced his public exhortations.

Lowth.

He married Margaret, daughter of Robert Pitt, Esq; of Blandford, by whom he had two sons and three daughters. (see the next article). He died in 1732, and was buried by his own orders in the church-yard at Buriton. He published, 1. A vindication of the divine authority and inspiration of the Old and New Testaments; 2. Directions for the profitable reading of the Holy Scripture; 3. Commentaries on the prophecies; and other works.

LOWTH (Robert), D.D. second son of the preceding Dr William Lowth, and bishop successively of St David's, Oxford, and London, was born on the 29th of November 1710, probably at Buriton in the county of Hants. He received the rudiments of his education in Winchester college, where his school exercises were distinguished by uncommon elegance; and having resided the requisite number of years in that seminary, in 1730 he succeeded on the foundation at New College, Oxford. He took the degree of M. A. June 8. 1737. Though his abilities must have been known to those with whom he was connected, he was not forward to appear before the world as a writer. At Oxford he continued many years improving his talents, with little notice from the great, and with preference so small as to have at present escaped the distinct recollection of some of his contemporaries.

He was not, however, suffered to languish for ever in obscurity. His genius and his learning forced themselves upon the notice of the illustrious society of which he was a member; and he was placed in a station where he was eminently qualified to shine. In 1741 he was elected by the university to the professorship of poetry, re-elected in 1743, and whilst he held that office he read his admirable lectures *De sacra poesi Hebraeorum*. In 1744 bishop Hoadley collated him to the rectory of Ovington in the county of Hants; added to it, nine years afterwards, the rectory of East Weedhay in the same county; and in the interim raised him to the dignity of archdeacon of Winchester. These repeated favours he some years afterwards acknowledged in the following manly and respectful terms of gratitude: "This address, My Lord, is not more necessary on account of the subject, than it is in respect of the author. Your Lordship, unsolicited and unasked, called him from one of those colleges to a station of the first dignity in your diocese, and took the earliest opportunity of accumulating your favour upon him, and of adding to that dignity a suitable support. These obligations he is now the more ready thus publicly to acknowledge, as he is removed out of the reach of further favours of the like kind. And though he hath relinquished the advantages so generously conferred on him, yet he shall always esteem himself highly honoured in having once enjoyed the patronage of the great advocate of civil and religious liberty."

On the 8th of July 1754 the university of Oxford conferred upon him the degree of D. D. by diploma; an honour which, as it is never granted but to distinguished merit, was probably conferred on Mr Lowth in consequence of his prelections on the Hebrew poetry, which had then been lately published. Having in 1749 travelled with Lord George and Lord Frederick Cavendish, he had a claim upon the patronage of the

Lowth.

Devonshire family; and in 1755, the late duke being then lord lieutenant of Ireland, Dr Lowth went to that kingdom as his grace's first chaplain. Soon after this appointment he was offered the bishopric of Limerick; but preferring a less dignified station in his own country, he exchanged it with Dr Leslie, prebendary of Durham and rector of Sedgfield, for these preferments. In November 1763, he was chosen F.R.S. In June 1766 he was, on the death of Dr Squire, preferred to the bishopric of St David's; which, in the October following, he resigned for that of Oxford, vacant by the translation of bishop Hume to Salisbury. In April 1777, he was translated to the see of London, vacant by the death of bishop Terrick; and in 1783 he declined the offer of the primacy of all England.

Having been long afflicted with the stone, and having long borne the severest sufferings of pain and sickness with the most exemplary fortitude and resignation, this great and good man died at Fulham, Nov. 3. 1787; and on the 12th his remains were privately interred in a vault at Fulham church, near those of his predecessor. He had married in 1752, Mary, the daughter of Laurence Jackson of Christ-church, Hants, Esq; by whom he had two sons and five daughters. His lady and two children only survived him.

His literary character may be estimated from the value and the importance of his works; in the account of which we may begin with his *Predilections on the Hebrew Poetry*. The choice of so interesting a subject naturally attracted general attention; and the work has been read with equal applause abroad and at home. In these predilections the author has acquitted himself in the most masterly manner, as a poet, a critic, and a divine; and such is the classic purity of his Latin style, that though we have read the work with the closest attention, and with no other view than to discover, if possible, an Anglicism in the composition, we never found a single phrase to which, we believe, a critic of the Augustan age could possibly have objected. This is an excellence to which neither Milton nor Johnson has attained; to which indeed no other English writer of Latin with whom we are acquainted has attained, unless perhaps Atterbury must be excepted. To the predilections was subjoined a short confutation of bishop Hare's system of Hebrew metre; which occasioned a Latin letter from Dr Edwards of Clare-hall, Cambridge, to Dr Lowth, in vindication of the Harian metre. To this the author of the predilections replied in a *larger confutation*, in which bishop Hare's system is completely overthrown, and the fallacy upon which it was built accurately investigated. After much attentive consideration, bishop Lowth has pronounced the metre of the Hebrew to be perfectly irrecoverable.

In 1758 he published *The life of William of Wykeham, bishop of Winchester*, with a dedication to Bishop Hoadley; which involved him in a dispute concerning a decision which that bishop had lately made respecting the wardenship of Winchester-college. This controversy was on both sides carried on with such abilities, that, though relating to a private concern, it may yet be read, if not with pleasure at least with improvement. The life of Wykeham is drawn from the most authentic sources; and affords much informa-

Lowth.

tion concerning the manners, and some of the public transactions of the period in which Wykeham lived, whilst it displays some private intelligence respecting the two literary societies of which he was the founder. In these two societies Dr Lowth was educated, and he gratefully expresses his obligations to them.

In 1762 was first published his *Short Introduction to English Grammar*, which has since gone through many editions. It was originally designed only for private and domestic use: but its judicious remarks being too valuable to be confined to a few, the book was given to the world; and the excellence of its method, which teaches what is right by showing what is wrong, has insured public approbation and very general use. In 1765 Dr Lowth was engaged with Bishop Warburton in a controversy, which made much noise at the time, which attracted the notice even of royalty, and of which the memory is still recent. If we do not wish to dwell on the particulars of this controversy, it is because violent literary contention is an evil, which, though like other war it may sometimes be unavoidable, is yet always to be regretted; and because the characters of learned, ingenious, and amiable men, never appear to less advantage than under the form which that state of hostility obliges them to assume. The two combatants indeed engaged with erudition and ingenuity such as is seldom brought into conflict; but it appears that, in the opinion of Dr Johnson, Warburton had the most scholastic learning, and that Lowth was the most correct scholar; that, in their contest with each other, neither of them had much argument, and that both were extremely abusive. We have heard, and we hope it is true, that they were afterwards reconciled, and expressed mutual regret for the violence of their past conduct.

In 1778 Bishop Lowth published his last great work, *A Translation of Isaiah*. To his literary and theological abilities, the translator joined the most critical knowledge of the character and spirit of the eastern poetry; and, accordingly, the prophecies of Isaiah (which, though almost always sublime or elegant, are yet sometimes obscure) were translated in a manner adequate to the highest expectations of the public. Several occasional discourses, which the Bishop, by his station, was at different times called upon to deliver, were of course published, and are all worthy of their excellent author; but there is one on the *kingdom of God*, on the extension and progressive improvement of Christ's religion, and on the means of promoting these by the advancement of religious knowledge, by freedom of inquiry, by toleration, and mutual charity, which may be distinguished above the rest, as exhibiting a most comprehensive view of the successive states of the Christian church, and containing the true principles of Christianity.

Of the Bishop's poetical pieces, none display greater merit than *Verses on the Genealogy of Christ*, and the *Choice of Hercules*, both written very early in his life. He wrote a spirited *Imitation of an Ode of Horace*, applied to the alarming situation of this country in 1745; and likewise some *verses on the death of Frederick prince of Wales*, with a few smaller poems. The following inscription on the tomb of his daughter, beautifully displays his paternal affection and classic taste. As it is short, and, in our opinion, has all the merit

merit of the ancient epitaph, the reader will probably be pleased with such a specimen of his lordship's Latinity.

*Cara, vale, ingenio preflans, pietate, pudore,
Et plusquam nate nomine cara, vale.*

*Cara Maria, vale. At veniet felicius ævum,
Quando iurum tecum, fin modo dignus, ero.*

*Cara, redi, lata tum dicam voces, paternas,
Eja, age in amplexus, cara Maria, rabi.*

Learning and taste, however, did not constitute Bishop Lowth's highest excellence. Eulogium itself can scarcely ascend to extravagance when speaking of him either as a private man or as a pastor of the church of Christ. His amiable manners rendered him an ornament to his high station, whilst they endeared him to all with whom he conversed; and his zeal for the interests of true religion made him eager to promote to places of trust and dignity such clergymen as he knew were best qualified to fill them. Of his modesty, gentleness, and pleasing conversation, we have the testimony of one whose decision will hardly be disputed.—“It would answer no end (says Bishop Warburton) to tell you what I thought of the author of Hebrew poetry, before I saw him. But this I may say, I was never more surprised, when I did see him, than to find him of such amiable and gentle manners, of so modest, sensible, and disengaged a deportment.” He united, indeed, in an eminent degree, the qualities of the gentleman with those of the scholar: he conversed with elegance, as he wrote with accuracy. As a husband, a father, or the master of a family, he was as nearly faultless as the imperfections of humanity will easily permit. His temper, when roused by what he thought improper conduct, was indeed susceptible of considerable warmth; but if he could be highly offended, upon a slight concession he could likewise forgive. His heart was tender and sympathetic. He possessed a mind which felt its own strength, and decided on whatever came before it with promptitude and firmness. In those trials where affliction was to be suffered or subdued, he behaved as a man and a Christian. His piety had no tincture of moroseness; his charity no leaven of ostentation. To his whole diocese he was endeared by his laudable discretion and his useful zeal. To the world he was a benefit by his exemplary life and his splendid abilities. And whilst virtue and learning are revered among men, the memory of LOWTH will be respected and admired.

LOXIA, in zoology; the name of a genus of birds of the order of passeres, the distinguishing characters of which are these: The bill is strong, convex above and below, and very thick at the base: the nostrils are small and round: the tongue is as if cut off at the end: the toes are four, placed three before and one behind; excepting in one species, which has only two toes before and one behind.

1. The *curvirostra*, or common cross-bill, which is about the size of a lark, is known by the singularity of its bill, both mandibles of which curve opposite ways and cross each other: The general colour of the plumage in the male is of a redlead inclining to rose-colour, and more or less mixed with brown: the wings and tail are brown; the legs black. The female is of a green colour, more or less mixed with

brown in those parts where the male is red. This species is a constant inhabitant of Sweden, Germany, Poland, Switzerland, Russia, and Siberia, where it breeds; but migrates sometimes in vast flocks into other countries, as is now and then the case in respect to England; for though in some years a few are met with, yet in others it has been known to visit us by thousands, fixing on such spots as are planted with pines, for the sake of the seeds, which are its natural food: it is observed to hold the cone in one claw like the parrot, and to have all the actions of that bird when kept in a cage. It is also found in North America and Greenland; and is said to make the nest in the highest parts of the fir-trees, fastening it to the branch with the resinous matter which exudes from the trees.

2. The *coccothraustes*, or hawfinch, is in length seven inches; breadth, 13: the bill is funnel-shaped, strong, thick, and of a dull pale pink colour; the breast and whole under side are of a dirty flesh colour; the neck ash-coloured; the back and coverts of the wings of a deep brown, those of the tail of a yellowish bay: the greater quill-feathers are black, marked with white on their inner webs: the tail is short, spotted with white on the inner sides; and the legs are of a flesh-colour. This species is ranked among the British birds; but only visits these kingdoms occasionally, and for the most part in winter, and never known to breed here. It is more plenty in France, coming into Burgundy in small flocks, about the beginning of April; and soon after making the nest, which is placed between the bifurcation of the branches of trees, about twelve feet from the ground: it is composed of small dry fibres, intermixed with liverwort, and lined with finer materials. The eggs are of a roundish shape, of a bluish green spotted with olive brown, with a few irregular black markings interperfed. It is also common in Italy, Germany, Sweden, and the west and southern parts of Russia, where the wild fruits grow. It feeds on berries, kernels, &c. and from the great strength of the bill, it cracks the stones of the fruit of the haws, cherries, &c. the greatest with ease.

3. The *enuleator*, or pine-grosbeak, is nine inches in length, and weighs two ounces. The bill is strong, dusky, and forked at the end: the head, back, neck, and breast, are of a rich crimson; the bottoms of the feathers ash-colour; the quill-feathers and tail dusky, their exterior edges of a dirty white: the legs are black. This species frequents the most northern parts of this kingdom, being only met with in Scotland, and especially the Highlands, where it breeds, and inhabits the pine-forests, feeding on the seeds, like the cross-bill. It is also found in all the pine-forests of Siberia, Lapland, and the northern parts of Russia: it is common about St Peterburgh in autumn, and is caught in great plenty at that time for the use of the table; returning north in spring. They are likewise common to the northern parts of America; appearing at Hudson's Bay in May, to which place they are said to come from the south, and are observed to feed on the buds of willow. The southern settlements are inhabited by them throughout the year, but the northern only in the summer season. Our last voyagers met with this bird in Norton Sound; it was also found at Aoonalashka.

4. The *pyrrhula*, or bullfinch, is so generally known

as almost to supercede description: The head, wings, and tail, are black; the breast and belly red; the upper tail coverts and vent white; and the breast ash-colour. The female differs in having the under parts of a reddish brown. This species is common in most parts of the continent of Europe, and throughout Russia and Siberia, at which last places it is caught for the table. It is pretty common in England; and builds in the bushes, five or six feet from the ground. The nest is composed chiefly of moss; and the eggs, which are five or six in number, are dirty bluish white, marked at the large end with dark spots. The time of breeding is about the end of May or beginning of June. In the summer it mostly frequents woods and the more retired places. In winter it approaches gardens and orchards, and has been generally stigmatised for making havoc among the buds of trees. From some late observations, however, it would appear, that the object of these birds is not the bud, but "the worm in the bud;" and that this species, in conjunction with various other species of small birds, are the frequent means of defending the embryo-fruits, and thence promoting their growth to maturity: for the warmth that swells the buds, not only hatches nidos (eggs) of unnumbered tribes of insects, whose parent flies, by an unerring instinct, laid them there,—but brings forward a numerous race already in a caterpillar state, that now issue from their concealments, and make their excursion along the budding branches, and would probably destroy every hope of fruitage, but for those useful instruments for its preservation, whose young are principally fed by eating caterpillars.—The bullfinch, in its wild state, has only a plain note; but when tamed it becomes remarkably docile, and may be taught any tune after a pipe, or to whistle any notes in the justest manner: it seldom forgets what it has learned; and will become so tame as to come at call, perch on its master's shoulders, and (at command) go through a difficult musical lesson. They may be also taught to speak, and some thus instructed are annually brought to London from Germany.

5. The *cœrulea*, or blue grosbeak, is the size of the bullfinch: The bill is stout, brown, and the base of it surrounded with black feathers which reach on each side as far as the eye: the whole plumage besides is of a deep blue, except the quills and tail, which are brown, with a mixture of green, and across the wing coverts a band of red: the legs are dusky. It is an inhabitant of South America; but is sometimes found in Carolina, where it is a very solitary bird, and seen only in pairs, but disappear in winter. It has only a single note.

6. The *violacea*, or purple grosbeak, is about the size of a sparrow: The bill is black: the plumage, violet black; except the irides, a streak over the eye, the chin, and the vent, which are red: the legs are dusky grey. This species inhabits the Bahama Islands, Jamaica, and the warmer parts of America.

7. The *cardinalis*, or cardinal grosbeak, is near eight inches in length. The bill is stout, and of a pale red colour: the irides are hazel: the head is greatly crested, the feathers rising up to a point when erect: round the bill, and on the throat, the colour is black; the rest of the bird of a fine red; the quills

and tail duller than the rest, and brownish within: the legs are the colour of the bill. The female differs from the male, being mostly of a reddish brown. This species is met with in several parts of North America; and has attained the name of nightingale from the fineness of its song, the note of which resembles that of the nightingale. In spring, and most part of the summer, it sits on the tops of the highest trees, singing early in the morning, and piercing the ear with its loud pipe. These birds are frequently kept in cages, in which they sing throughout the year, with only short intervals of muteness. They are fond of *maize* and *buck-wheat*; and will get together great hoards of these, often as much as a bushel, which they artfully cover with leaves and small twigs, leaving only a small hole for entrance into the magazine. They are also fond of *bees*. They come the beginning of April into New York and the Jerseys, and frequent the *Magnolia* swamps during the summer: in autumn they depart towards Carolina. They are pretty tame, frequently hopping along the road before the traveller; but are not gregarious, scarce ever more than three or four being met with together. From their being familiar birds, attempts have been made to breed them in cages, but without success.

8. The *orix*, or grenadier grosbeak, is about the size of a house-sparrow. The forehead, sides of the head, and chin, are black; the breast and belly the same: the wings are brown, with pale edges; and the rest of the body of a beautiful red colour: the legs are pale. These birds are inhabitants of Saint Helena; they are also in plenty at the Cape of Good Hope, where they frequent watery places that abound with reeds, among which they are supposed to make their nest. If (as is supposed) this be the same with Kolben's Finch, he says that the nest is of a peculiar contrivance, made with small twigs, interwoven very closely and tightly with cotton, and divided into two apartments with but one entrance (the upper for the male, the lower for the female), and is so tight as not to be penetrated by any weather. He adds, that the bird is scarce only in summer, being in the winter wholly ash-coloured. These birds, seen among the green reeds, are said to have a wonderful effect; for, from the brightness of their colours, they appear like so many *scarlet lilies*.

9. The *Philippina*, or Philippine grosbeak, is about the size of a sparrow: the top of the head, the hind part of the neck and back, and the scapulars, are yellow, the middle of the feathers brown: the lower part of the back is brown, with whitish margins: the fore part of the neck and breast are yellow; and from thence to the vent yellowish white; the wing-coverts brown, edged with white: the quills are brown, with pale rufous or whitish edges; and the tail the same: the legs are yellowish. These birds inhabit the Philippine Islands; and are noted for making a most curious nest, in form of a long cylinder, swelling out into a globose form in the middle. This is composed of the fine fibres of leaves, &c. and fastened by the upper part to the extreme branch of a tree. The entrance is from beneath; and, after ascending the cylinder as far as the globular cavity, the true nest is placed on one side of it; where this little architect

Loxia lays her eggs, and hatches her brood in perfect security.

A variety of this species, the *Bagfaschat* (Buff. iii. 469), an inhabitant of Abyssinia, makes a very curious nest like the former, but a little different in shape; and is said to have somewhat of a spiral form, not unlike that of a nautilus. It suspends it, like the other, on the extreme twig of some tree, chiefly one that hangs over some still-water; and always turns the opening towards that quarter from whence least rain may be expected.

10. The Abyssinica, or Abyssinian grosbeak, is about the size of the hawfinch: the bill is black: the irides are red: the top and sides of the head, throat, and breast, are black: the upper parts of the body, belly, and thighs, pale yellow, inclining to brown where the two colours divide: the scapulars are blackish; the wing-coverts brown, bordered with grey; the quills and tail brown, edged with yellow: the legs are of a reddish grey. This bird is found in Abyssinia; and makes a curious nest of a pyramidal shape, which is suspended from the ends of branches like the others. The opening is on one side, facing the east: the cavity is separated in the middle by a partition; up which the bird rises perpendicularly about half-way, when descending, the nest is within the cavity on one side. By this means the brood is defended from snakes, squirrels, monkeys, and other mischievous animals, besides being secure from rain, which in that country sometimes lasts for six months together.

11. The penzilis, or penzile grosbeak, (the *Toddy-bird* of Fryer), is about the size of the house-sparrow: the bill is black: the irides are yellow: the head, throat, and fore part of the neck, the same: from the nostrils springs a dull green stripe, which passes through the eye and beyond it, where it is broader: the hind part of the head and neck, the back, rump, and wing-coverts, are of the same colour: the quills are black, edged with green; the belly is deep grey, and the vent of a rufous red: the tail and legs are black. This species is found at Madagascar; and fabricates a nest of a curious construction, composed of straw and reeds interwoven in shape of a bag, the opening beneath. It is fastened above to a twig of some tree; mostly to those growing on the borders of streams. On one side of this, within, is the true nest. The bird does not form a new nest every year, but fastens a new one to the end of the last; and often as far as five in number, one hanging from another. These build in society, like rooks; often five or six hundred being seen on one tree. They have three young at each hatch.

Kæmpfer† mentions a bird similar to this, if not the same, which makes the nest, near Siam, on a tree with narrow leaves and spreading branches, the size of an apple-tree: the nest in the shape of a purse, with a long neck, made of dry grass and other materials, and suspended at the ends of the branches; the opening always to the north-west. He counted fifty on one tree only; and describes the bird itself as being like a Canary-bird, of a dark yellow, and chirps like a sparrow.

† Account of India and Persia, p. 76. Fryer† also talks of the ingenuity of the *Toddy Bird*, making a nest "like a steeple, with winding meanders," and tying it by a slender thread to the

bough of a tree. "Hundreds of these pendulous nests may be seen on these trees."

12. The chloris, or greenfinch, is a well-known bird: the general colour is a yellowish green, palest on the rump and breast, and inclining to white on the belly; the quills are edged with yellow, and the four outer tail-feathers are yellow from the middle to the base; the bill is pale-brown, and stout; and the legs are of a flesh-colour.—This species is pretty common in Britain, and flies in troops during the winter. It makes the nest in some low bush or hedge, composed of dry grass, and lined with hair, wool, &c. laying five or six greenish eggs, marked at the larger end with red brown; and the male takes his turn in sitting. This bird soon becomes tame; even old ones being familiar almost as soon as caught: it lives five or six years. Like the chaffinch, it is apt to grow blind if exposed to the sun. This species is also pretty common every where on the continent of Europe: but not very frequent in Russia; and is not at all found in Siberia, though it has been met with in Kamtscharka. It is sufficiently common both in Cumberland and Scotland: yet in the first, it is scarce ever observed in the winter season; but the last week in March becomes plentiful, and breeds as in other parts of England.

13. The Bengalenis, or Bengal grosbeak, is a trifle bigger than a house-sparrow: the bill is of a flesh-colour; the irides are whitish; the top of the head of a golden yellow; the upper parts of the body are brown, with paler edges; the sides of the head and under parts rufous white; across the breast is a brown band, uniting to, and of the same colour with, the upper parts of the body; the legs are of a pale yellow, the claws grey. This species (thus described by Mr Latham) seems to be the same with the Indian grosbeak, described as follows in the *Astic Researches*. "This little bird, called *boyā* in Hindi, *berbera* in Sanscrit, *bābū* in the dialect of Bengal, *cibā* in Persian, and *tenawait* in Arabic, from his remarkably pendant nest, is rather larger than a sparrow, with yellow-brown plumage, a yellowish head and feet, a light-coloured breast, and a conic beak very thick in proportion to his body. This bird is exceedingly common in Hindostan: he is astonishingly sensible, faithful, and docile, never voluntarily deserting the place where his young were hatched, but not averse, like most other birds, to the society of mankind, and easily taught to perch on the hand of his master. In a state of nature he generally builds his nest on the highest tree that he can find, especially on the palmyra, or on the Indian fig-tree, and he prefers that which happens to overhang a well or a rivulet: he makes it of grass, which he weaves like cloth and shapes like a large bottle, suspending it firmly on the branches, but so as to rock with the wind, and placing it with its entrance downwards to secure it from birds of prey. His nest usually consists of two or three chambers; and it is the popular belief that he lights them with fire-flies, which he catches alive at night, and confines with moist clay or with cow-dung: That such flies are often found in his nest, where pieces of cow-dung are also stuck, is indubitable; but as their light could be of little use to him, it seems probable that he only feeds on them. He may be taught with ease to fetch a piece of paper, or any

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small thing that his master points out to him : It is an attested fact, that if a ring be dropped into a deep well, and a signal given to him, he will fly down with amazing celerity, catch the ring before it touches the water, and bring it up to his master with apparent exultation ; and it is confidently asserted, that if a house or any other place be shown to him once or twice, he will carry a note thither immediately on a proper signal being made. One instance of his docility I can myself mention with confidence, having often been an eye-witness of it. The young Hindoo women at Benares, and in other places, wear very thin plates of gold, called *ticas*, slightly fixed by way of ornament between their eye-brows ; and when they pass through the streets, it is not uncommon for the youthful libertines, who amuse themselves with training bayas, to give them a signal, which they understand, and send them to pluck the pieces of gold from the foreheads of their mistresses, which they bring in triumph to the lovers. The bayas feed naturally on grasshoppers and other insects ; but will subsist, when tame, on pulse macerated in water : his flesh is warm and drying, of easy digestion, and recommended in medical books as a solvent of stone in the bladder or kidneys ; but of that virtue there is no sufficient proof. The female lays many beautiful eggs resembling large pearls ; the white of them, when they are boiled, is transparent, and the flavour of them is exquisitely delicate. When many bayas are assembled on a high tree, they make a lively din ; but it is rather chirping than singing : Their want of musical talents is however amply supplied by their wonderful sagacity, in which they are not excelled by any feathered inhabitant of the forest."

14. The nigra, or black grosbeak, is about the size of a Canary bird : the bill is black, stout, and deeply notched in the middle of the upper mandible : the plumage is black, except a little white on the fore part of the wing and base of the two first quills : the legs are black. It inhabits Mexico.

15. The minuta, or minute grosbeak, is about the size of a wren : the bill is stout, thick, short, and brown : the upper parts of the plumage are grey brown, the under parts and rump ferruginous chestnut ; the fourth, fifth, and sixth quills are white at the base : the legs are brown. It inhabits Surinam and Cayenne. — It is said to keep paired to its mate the whole year ; and is a lively, and not very tame bird. It mostly frequents lands which have lain for some time uncultivated ; and lives both on fruits and seeds. It makes a roundish nest, the hollow of which is two inches in diameter, composed of a reddish herb, and placed on the trees which it frequents. The female lays three or four eggs.

16. The focia, or sociable grosbeak, is about the size of a bullfinch : The general colour of the body above is a rufous brown, the under parts yellowish : the beak and muzzle are black ; the legs brown ; and the tail is short. It inhabits the interior country at the Cape of Good Hope ; where it was discovered by Mr Paterfon. — These birds, according to our author, live together in large societies, and their mode of nidification is extremely uncommon. They build in a species of *Mimosa* which grows to an uncommon size ; and which

N° 188.

they seem to have selected for that purpose, as well on account of its ample head, and the great strength of its branches, calculated to admit and to support the extensive buildings which they have to erect, as for the tallness and smoothness of its trunk, which their great enemies, the serpent-tribe, are unable to climb. The method in which the nests themselves are fabricated, is highly curious. In the one described by Mr Paterfon there could be no less a number (he says) than from 800 to 1000 residing under the same roof. He calls it a roof, because it perfectly resembles that of a thatched house ; and the ridge forms an angle so acute and so smooth, projecting over the entrance of the nest below, that it is impossible for any reptile to approach them. The industry of these birds " seems almost equal (says our author) to that of the bee ; throughout the day they appear to be busily employed in carrying a fine species of grass, which is the principal material they employ for the purpose of erecting this extraordinary work, as well as for additions and repairs. Though my short stay in the country was not sufficient to satisfy me by ocular proof, that they added to their nest as they annually increased in numbers, still from the many trees which I have seen borne down with the weight, and others which I have observed with their boughs completely covered over, it would appear that this is really the case ; when the tree which is the support of this aerial city is obliged to give way to the increase of weight, it is obvious that they are no longer protected, and are under the necessity of rebuilding in other trees. One of these deserted nests I had the curiosity to break down, so as to inform myself of the internal structure of it, and found it equally ingenious with that of the external. There are many entrances, each of which forms a regular street, with nests on both sides, at about two inches distance from each other. The grass with which they build is called the Boshman's grass : and I believe the seed of it to be their principal food ; though, on examining their nests, I found the wings and legs of different insects. From every appearance, the nest which I dissected had been inhabited for many years ; and some parts of it were much more complete than others : this therefore I conceive nearly to amount to a proof, that the animals added to it at different times, as they found necessary, from the increase of the family, or rather of the nation or community."

17. The triadactyla, or three-toed grosbeak (the guiso balito of *Buffon*), has only three toes, one before and one behind. The bill is toothed on the edges : the head, throat, and fore-part of the neck are of a beautiful red, which is prolonged in a narrow band quite to the vent ; the upper part of the neck, back, and tail, are black ; the wing coverts brown, edged with white ; quills brown, with greenish edges ; and legs a dull red : the wings reach half way on the tail. — This species inhabits Abyssinia ; where it frequents woods, and is a solitary species. It feeds on kernels of seeds, which it breaks with ease with its bill. The name in its native place is *guiso balito dimmo-won jerck*. *Buffon's* figure is from Mr Bruce's drawings.

There are 6 other species of this genus ; the whole number, besides varieties, enumerated in the *Syst. Nat.* (Gmelin), and in Mr Latham's *Index Ornith.* being 93.



A. Bell. Pin. M. Schæpht. fecit.

Loyola
||
Lubec.

On Plate CCLXXIV. are given specimens of six, viz. A, the Cærulea; B, the Longicauda; C, the Socia; D, the Cardinalis; E, the Nigra; F, the Violaeca.

LOYOLA (Ignatius). See IGNATIUS.

LOZENGE, in heraldry, a four-cornered figure, resembling a pane of glass in old cafetems. See HERALDRY, p. 455. col. 1. Though all heralds agree, that single ladies are to place their arms on lozenges, yet they differ with respect to the causes that gave rise to it. Plutarch says, in the life of Theseus, that in Megara, an ancient town of Greece, the tomb-stones, under which the bodies of the Amazons lay, were shaped after that form; which some conjecture to be the cause why ladies have their arms on lozenges. *S. Petra Sancta* will have this shield to represent a *cubion*, whereupon women used to fit and spin, or do other housewifery. Sir J. Ferne thinks it is formed from the shield called *teffera*, which the Romans finding unfit for war, did allow to women to place their ensigns upon, with one of its angles always uppermost.

LOZENGES, among jewelers, are common to brilliant and rose diamonds. In brilliants, they are formed by the meeting of the skill and star facets: on the bezel; in the latter, by the meeting of the facets in the horizontal ribs of the crown. See FACETS.

LOZENGE is also a form of medicine, made into small pieces, to be held or chewed in the mouth till they are melted there: the same with what are otherwise called *trochisci*, "troches."

LUBEC, a city and port-town of Germany, in the circle of Lower Saxony and duchy of Holstein, in E. Long. 10. 35. N. Lat. 54. 20. It stands at the conflux of several rivers, the largest of which is the Trave, 12 miles from the Baltic, where it has a fine harbour, and 40 north-east of Hamburg. By the Steckenitz, another of those rivers, it has a communication with the Elbe, and consequently with the German ocean. The city lies on the side of a hill, with the Trave, increased by the Steckenitz on the one side, and the Wackenitz on the other; and is strongly fortified with bastions, moats, walls, and ramparts; the last of which are planted with trees, and form an agreeable walk. Lubec being formerly the chief of the Hanse towns, was very powerful in consequence of the vast trade it carried on; but a great part of that trade is now transferred to Hamburg; however, it is still said to employ 150 of its own ships, and has a great share of the Baltic trade. It is about two miles in length, and more than one in breadth. The houses are all of stone, but old-fashioned. Several of the streets have on each side rows of lime-trees, with canals in the middle, like those of Holland. The public structures consist of the ancient cathedral of the bishopric of Lubec, and several other Lutheran churches; a nursery for 22 ladies, with an abbess and prioress; a poor-house, an alms-house, and house of correction; an orphan-house; a hospital dedicated to the Holy Ghost; a house in which poor travellers are entertained three days, and then sent forward with a pass; but such as happen to be sick, are provided with all necessities till they recover or die; the city-armoury, a grammar-school of seven classes, the Calvinist church, and the Popish chapel. The deputies of the Hanse-towns used to meet here formerly in the town-house.

VOL. X. Part I.

Lubec
||
Lubna.

An alliance still subsists between Lubec, Hamburg, and Bremen; and these cities, under the name of *Hanse-towns*, negotiate treaties with foreign powers. Here are divers manufactures, and the city's territory is about 60 miles in compass. In the diet of the empire Lubec is possessed of the third seat among the Rhenish imperial cities; and among those of the circle, has the first. In the matricula, its assessment is 480 florins, and to the chamber of Wetzlar it pays 557 rix-dollars and 88 kruiters. The city is a republic without itself, and both makes and executes laws in regard to civil and criminal matters, &c. A father and son, or two brothers, cannot be in the regency at the same time. The famous league of the Hanse-towns was begun here in 1164. This city had its charter of privileges from the emperor Frederic II. Formerly it carried on wars, both offensive and defensive, for several years, not only against the dukes of Mecklenburg, but against the kings of Sweden and Denmark; particularly in 1428, when it fitted out 250 ships of force against Eric X. king of Denmark. There are about 20 churches in Lubec, with lofty steeples or spires. The Trave brings ships of burden into the very heart of the city; but the largest unload at Travemunde, i. e. the mouth of the Trave, eight or ten miles distant. Formerly it is said to have employed no less than 600 ships. In the famous cellar here, it is said there is wine 200 years old. The church of St Mary's, a noble lofty pile, is supported by tall pillars, all of one stone each, and has a high spire, covered with gilt lead. The town's garrison consists of about 700 or 800 men. The revenue of its Lutheran bishop, though he is a prince of the empire, is said not to exceed 3000 pounds.

LUBEN, a city of Germany, in the marquise of Lower Lusatia. It is situated on the river Spree, and is the capital of a small circle of the same name. It is the seat of the diets, and of the chief tribunals and offices; and has several churches, with a noble land-house and hospital. E. Long. 14. 25. N. Lat. 52. 0.

LUBIENIETSKI (Stanislaus), a Polish gentleman, descended from a noble family, and born at Cracow in 1623, was educated by his father with great attention. He became a celebrated Socinian minister; and took great pains to obtain a toleration from the German princes for his Socinian brethren. His labours, however, were ineffectual; being himself persecuted by the Lutheran ministers, and banished from place to place; until at length he was banished out of the world, with his two daughters, by poison, his wife narrowly escaping, in 1675. We have of his writing *A history of the reformation in Poland; A treatise on comets*; with other works in Latin.

LUBIN (Eilhard), was professor of poetry in the university of Rostock in 1595; and ten years after, was promoted to the professorship of divinity. He wrote notes on Anacreon, Juvenal, Persius, &c. and several other works; but that which made the most noise is a Treatise on the nature and origin of evil, intitled, *Phosphorus de causa prima et natura mali*, printed at Rostock in 1596; in which we have a curious hypothesis to account for the origin of moral evil. He supposed two co-eternal principles; not matter and va-

R r crum,

cius, as Epicurus did; but God, and *Nihilum* or *Nothings*. This being published against by Grawer, was defended by Lubin; but after all, he is deemed better acquainted with polite literature than with divinity. He died in 1621.

LUBLIN, a handsome and considerable town of Poland, capital of the palatinate of the same name, with a citadel, a bishop's see, an university, and a handsome Jewish synagogue. Here the judicial courts for all Poland are held. It has three fairs, frequented by merchants from all nations. It is seated on the river Byłczyca. E. Long. 22. 31. N. Lat. 51. 26.

LUCA, (anc. geog.), a town of Etruria, on the river Aufer; a colony and a municipium. Now *Lucca*, capital of the republic of that name, near the river Secchia. E. Long. 11. 20. Lat. 43. 45.

LUCANIA, a country of Italy, and a part of Magna Græcia; bounded on the north by the river Silurus by which it was separated from the Picentini, and by the river Bradanus by which it was parted from the Apuli Peucetii; on the south by the Laus, which separated it from the Brutii; on the east by the Sinus Tarentinus; and on the west by the Tufcan sea. *Lucani*, the people, descendants of the Samnites. *Lucania* the epithet, (Horace). *Lucæ boves* denoted elephants; first seen in Pyrrhus's wars in Lucania, whence the appellation (Pliny).

LUCANUS (Marcus Annæus), a Latin poet, born at Corduba in Spain, about A. C. 39. He was the son of Annæus Mela, the youngest brother of Seneca; and was conveyed to Rome from the place of his nativity at the age of eight months: a circumstance, as his more indulgent critics observe, which sufficiently refutes the censure of those who consider his language as provincial. At Rome he was educated under the Stoic Cornutus, so warmly celebrated by his disciple Persius the satirist, who was the intimate friend of our poet. In the close of his education, Lucan is said to have passed some time at Athens. On his return to Rome he rose to the office of quaestor, before he had attained the legal age. He was afterwards inrolled among the augurs; and married a lady of noble birth, and of a most amiable character. Lucan had for some time been admitted to familiarity with Nero, when the emperor chose to contend for poetical honours by the public recital of a poem he had composed on Niobe; and some verses of this imperial production are supposed to be preserved in the first satire of Persius. Lucan had the hardiness to repeat a poem on Orpheus, in competition with that of Nero; and, what is more remarkable, the judges of the contest were just and bold enough to decide against the emperor. From hence Nero became the persecutor of his successful rival, and forbade him to produce any poetry in public. The well-known conspiracy of Piso against the tyrant soon followed; and Tacitus, with his usual sarcastic severity, concludes that Lucan engaged in the enterprise from the poetical injuries he had received: "a remark (says Mr Hayley), who has endeavoured to refute the imputation) which does little credit to the candour of the historian; who might have found a much nobler, and I will add, a more probable motive for his conduct, in the generous ardor of his character, and his passionate adoration of freedom. In the sequel of his narration, Tacitus alleges a charge against our

poet, which, if it were true, must lead us to detect him as the most abject of mankind. The historian asserts, that Lucan, when accused of the conspiracy, for some time denied the charge; but corrupted at last by a promise of impunity, and desirous to atone for the tardiness of his confession, accused his mother Atilla as his accomplice. This circumstance is so improbable in itself, and so little consonant to the general character of Lucan, that some writers have treated it with contempt, as a calumny invented by Nero, to vilify the object of his envious abhorrence. But the name of Tacitus has given such an air of authority to the story, that it may seem to deserve a more serious discussion, particularly as there are two subsequent events related by the same historian, which have a tendency to invalidate the accusation so injurious to our poet. The events I mean are, the fate of Annæus, and the escape of Atilla, the two parents of Lucan. The former died in consequence of an accusation brought against him, after the death of his son, by Fabius Romanus, who had been an intimate with Lucan, and forged some letters in his name, with the design of proving his father concerned in the conspiracy. These letters were produced to Nero, who sent them to Annæus, from an eager desire, says Tacitus, to get possession of his wealth. From this fact two inferences may be drawn, according to the different lights in which it may be considered:—If the accusation against Annæus was just, it is clear that Lucan had not betrayed his father, and he appears the less likely to have endangered by his confession the life of a parent, to whom he owed a still tender regard.—If Annæus was not involved in the conspiracy, and merely put to death by Nero for the sake of his treasure, we may the more readily believe, that the tyrant who murdered the father from avarice, might calumniate the son from envy. But the escape of Atilla affords us the strongest reason to conclude that Lucan was perfectly innocent of the abject and unnatural treachery of which Tacitus has supposed him guilty. Had the poet really named his mother as an accomplice, would the vindictive and sanguinary Nero have spared the life of a woman whose family he detested, particularly when other females were put to death for their share in the conspiracy? That Atilla was not in that number, the historian himself informs us in the following remarkable sentence, "*Atilla mater Annæi Lucani, sine absolutione, sine supplicio, dissimulata;*" thus translated by Gordon: "The information against Atilla, the mother of Lucan, was dissimulated; and, without being cleared, she escaped unpunished."

The preceding remarks will, our author hopes, vindicate to every candid mind the honour of Lucan, whose firmness and intrepidity of character are indeed very forcibly displayed in that picture of his death which Tacitus himself has given us. He was condemned to have his veins cut, as his uncle Seneca had before him. Lucan, "while his blood issued in streams, perceiving his feet and hands to grow cold and stiffen, and life to retire by little and little to the extremities, while his heart was still beating with vital warmth, and his faculties nowise impaired, recollected some lines of his own, which described a wounded soldier expiring in a manner that resembled this. The lines themselves he rehearsed; and they were the last words he ever uttered." The critics differ concerning the
verse

* In the
Notes to his
Second Epistle on Epics
Poetry.

Lucanus. verses of the Pharfalia which the author quoted in so memorable a manner. The two passages he is supposed to have repeated are the following; of which Lippius contends for the latter.

Sanguis erant lacrymæ: quæcunque foramina nova
Humor, ab his largus manat error: ora redundant,
Et patulae nares: sudor rubet: omnia plenis
Membra fluent venis: totum est pro vulnere corpus.
Lib. ix. 814.

Now the warm blood at once, from every part,
Ran purple pool a down, and drain'd the fainting heart.
Blood falls for tears; and o'er his mournful face
The ruddy drops their tainted passage trace.
Where'er the liquid juices find a way,
There streams of blood, there crimson rivers stray.
His mouth and gushing nostrils pour a flood,
And e'en the pores o'ze out the trickling blood;
In the red deluge all the parts lie drown'd,
And the whole body seems one bleeding wound.

Rowe.

Scinditur avulsis; nec sicut vulnere sanguis
Emittit lentus; ruptis cadit undique venis,
Difcussaque arinis, diversa in membra meatis,
Interceptus aquis. *Lib. iii. v. 638.*

No single wound the gaping rupture seems,
Where trickling crimson wells in slender streams;
But, from an opening horrible and wide,
A thousand vessels pour the bursting tide:
At once the winding channel's course was broke,
Where wand'ring life her mazy journey took;
At once the currents all forgot their way,
And lost their purple in the azure sea.

Rowe.

Such was the death of Lucan before he had completed his 27th year.—His wife, Polla Argentaria, is said to have transcribed and corrected the three first books of the Pharfalia after his death. It is much to be regretted (Mr Hayley observes) that we possess not the poem which he wrote on the merits of this amiable and accomplished woman; but her name is immortalized by two surviving poets of that age. The vene-

Lucanus. ration which she paid to the memory of her husband is recorded by Martial; and more poetically described in that pleasing and elegant little production of Statius, *Genethliacum Lucani*, a poem said to have been written at the request of Argentaria. The author, after invoking the poetical deities to attend the ceremony, touches with great delicacy and spirit on the compositions of Lucan's childhood, which are lost, and the Pharfalia, the production of his early youth: he then pays a short compliment to the beauty and talents of Argentaria; laments the cruel fate which deprived her so immaturely of domestic happiness; and concludes with an address to the shade of Lucan, which, with Mr Hayley's translation, we shall subjoin in a Note, as it seems to furnish a strong presumption of Lucan's innocence in regard to one of the accusations mentioned above (A). "Had he been really guilty of basely endangering the life of his mother (says Mr Hayley), it is not probable that his wife would have honoured his memory with such enthusiastic veneration; or that Statius, in verses designed to do him honour, would have alluded to the mother of Nero. If his character as a man has been injured by the historian (continues Mr Hayley), his poetical reputation has been treated not less injuriously by the critics. Quintilian, by a frivolous distinction, disputes his title to be classed among the poets; and Scaliger says, with a brutality of language disgraceful only to himself, that he seems rather to bark than to sing. But these insults may appear amply compensated, when we remember, that in the most polished nations of modern Europe the most elevated and poetic spirits have been his warmest admirers; that in France he was idolized by Corneille, and in England translated by Rowe.—The severest censures on Lucan have proceeded from those who

R r 2 have

(A) At tu, seu rapidum poli per axem
Famæ curribus arduis levatus,
Qua surgunt animæ potentiores,
Terras despicis, et sepulchra ridens:
Seu pacis meritum nemus reclusæ
Felix Elysia tenes in oris,
Quo Pharfalia turba congregatur;
Et te nobile carmen innotuit
Pompeii comitatus et Cæsar:—
Tu magna facer et superbis umbræ
Nefcis Tartaron, et procul aocentum
Audis verbera, pallidumque visa
Matris lampade respicias Neronem.
Adsis lucidus; et vocante Polla
Unam, quæso, diem dædes silentum
Exores: solet hoc patere limen
Ad nuptas redeuntibus maritis.
Hæc te non thialis prociæ dolosis
Vulsi numinis induit figuras;
Ipsum sed colit, et frequentat ipsum
Imis altius initum medullis:
Ac solatia vana subministrat
Vultus, qui simili notatus auro
Stratis prænitit, excubaque somno
Securæ. Procul hinc abite mortes;
Hæc viræ genitalis est origo;
Cedat luctus atrox, frequentatque manent
Jam dulces lacrymæ, doloque festus
Quæquid severat ante nunc adoret.

But you, O! whether to the skies
On Fame's triumphant car you rise,
(Where mightier souls new life assume)

And mock the confines of the tomb;
Or whether in Elysium blest
You grace the groves of sacred rest,
Where the Pharfalian heroes dwell;
And, as you strike your epic flail,
The Pompeys and the Cætos throng
To catch the animating song;
Of Tartarus the dread controul
Binds not your high and hallow'd soul:
Distant you hear that waiting court,
And see the guilty Nero's ghost
Grow pale with anguish and affright,
His mother flashing on his sight.
Be present to your Polla's vows,
While to your honour'd name the bows!
One day let your intreaties gain
From those who rule the shadowy train!
Their gates have op'd to bless a wife,
And given a husband back to life.
In you the tender fair invites
No fancied god with frantic rites:
You are the object of her prayers,
You in her inmost heart she bears:
And, stamp on mimic gold, your head
Adorns the faithful mourner's bed,
And soothes her eyes before they close,
The guardian of her chaste repose.

Away with all funeral state!
From hence his nobler life we date:
Let mourning change the pang, severe
To fond devotion's grateful tear!
And festal grief, its anguish o'er,
What it lamented, now adore!

Lucanus,
Lucar.

have unfairly compared his language to that of Virgil: but how unjust and absurd is such a comparison! it is comparing an uneven block of porphyry, taken rough from the quarry, to the most beautiful superficies of polished marble. How differently should we think of Virgil as a poet, if we possessed only the verses which he wrote at that period of life when Lucan composed his *Pharsalia*! In the disposition of his subject, in the propriety and elegance of diction, he is undoubtedly far inferior to Virgil: but if we attend to the bold originality of his design, and to the vigour of his sentiments; if we consider the *Pharsalia* as the rapid and uncorrected sketch of a young poet, executed in an age when the spirit of his countrymen was broken, and their taste in literature corrupted; it may justly be esteemed as one of the most noble and most wonderful productions of the human mind."—Lucan wrote several poems; but we have none remaining beside his *Pharsalia*, of which an excellent English version has been given by Mr Nicholas Rowe.

LUCANUS, the STAG-BEETLE, in zoology; a genus of insects of the order coleoptera: The antennæ end in a club or knob, which is compressed or flattened on one side, and divided into short laminae resembling the teeth of a comb; the jaws are porrected or advanced before the head, and are dentated. There are 20 species. The largest, as well as the most singular, is the cervus; which is easy to be known by two large moveable maxillæ, resembling in form the horns of a stag, which project from its head, and have in a special manner acquired it the appellation of Stag-Beetle. Those maxillæ, broad and flat, equal to one third of the insect's length, have in the middle, towards their inner part, a small branch, and at their extremity are forked. Besides this, they have several small teeth throughout their whole length. The head that bears these maxillæ is very irregular, very broad and short. The thorax is something narrower than the head and body, and margined round. The elytra are very plain, without either streaks or lines. The whole animal is of a deep brown colour. It is commonly found upon the oak, but is scarce in the neighbourhood of London, and though the largest of coleopterous insects to be met with in this part of the world, it is much smaller than those of the same species that are found in woody countries. This creature is strong and vigorous, and its horns, with which it pinches severely, are carefully to be avoided.—The jaws are sometimes as red as coral, which gives this insect a very beautiful appearance; the female is distinguished by the shortness of the jaws, which are not half so long as those of the male.—These insects feed on the liquor that oozes from oaks, which they suck with their trunk or tongue. The females deposit their eggs in the trunks of decayed trees, such as the oak and the ash. The larvæ or grubs lodge under the bark and in the hollow of old trees, which they eat into and reduce into fine powder, and there transform themselves into chrysalids. They are common in Kent and Sussex, and are sometimes met with in other parts of England. The porrected jaws are particularly useful to these animals, in stripping off the bark from trees, and affixing themselves thereby to the tree, while they suck with their trunk the juice that oozes from it.

LUCAR DE BARAMEDA (St), a handsome and

considerable town of Spain, with a very good harbour, well defended, in Andalusia. It was once the greatest port in Spain, before the galleons unloaded their treasure at Cadiz. It is seated at the mouth of the river Guadalquivir. W. Long. 6. 5. N. Lat. 36. 40.

LUCAR de Guadiana (St), a strong town of Spain, in Andalusia, on the confines of Algarve; seated on the river Guadiana, with a little harbour. W. Long. 5. 59. N. Lat. 37. 32.

LUCAR la Mayor (St), a small town of Spain, in Andalusia, with the title of a duchy. It is seated on the river Guadiana, in W. Long. 6. 32. N. Lat. 37. 21.

LUCARIA, a feast celebrated at Rome on the 18th of July, in memory of the flight of the Romans into a great wood, where they found an asylum, and saved themselves from destruction. This wood, in which they found protection, was situated between Tyber and the *Via Salaria*. The enemies from whom the Romans fled were the Gauls.—On this festival, Plutarch tells us, it was customary to pay the actors, and such as contributed to the public amusement, with the money arising from the felling of wood. This money was called *lucar*. It is obvious, from what has been observed, that *lucar* and *lucaria* are derived from *lucur*, a grove.

LUCAS (Jacobs), an eminent artist, more generally known by the name of *Lucas van LEYDEN*, or *Hugens*, was born at Leyden in 1494. He received his first instructions in the art of painting from his father Hugues Jacobs; but completed his studies in the school of Cornelius Engelbrecht. He gained much money by his profession; and being of a generous turn of mind, he spent it freely, dressed well, and lived in a superior style. It is said, that, a few years before his death, he made a tour into Zealand and Brabant; and during his journey, a painter of Flushing, envious of his great abilities, gave him poison at an entertainment; which, though very slow, was too fatal in its effect, and put an end to his life, after six years languishing under its cruel influence. Others, denying the story of the poison, attribute his death to his incessant industry. The superiority of this artist's genius manifested itself in his infancy: for his works, even from the age of nine, were so excellent, as to excite the admiration of all contemporary artists; and when he was about 15, he painted a St Hubert, which gained him great applause. His tone of colouring (Mr Pilkington observes) is good, his attitudes (making a reasonable allowance for the stiff German taste) are well-chosen, his figures have a considerable expression in their faces, and his pictures are very highly finished. He endeavoured to proportion the strength of his colouring to the different degrees of distance in which his objects were placed: for in that early time, the true principles of perspective were but little known, and the practice of it was much less observed. In the town-hall at Leyden, the most capital picture of Lucas, the subject of which is the Last Judgement, is preserved with great care; the magistrates having refused very large sums which have been offered for it.

This artist painted not only in oil, but also in distemper and upon glass. Nor was he less eminent for his engraving than for his painting. He carried on a familiar and friendly correspondence with Albert Durer,

Lucar
Lucas.

Plate
CCLXXV.

Lucas.

Durer, who was his cotemporary; and, it is said, that as regularly as Albert Durer published one print, Lucas published another, without the least jealousy on either side, or wish to depreciate each other's merit. And when Albert came into Holland upon his travels, he was received by Lucas in a most cordial and affectionate manner. His style of engraving, however, according to Mr Strutt, differed considerably from that of Albert Durer, "and seems evidently to have been founded upon the works of Israel van Mechlen. His prints are very neat and clear, but without any powerful effect. The strokes are as fine and delicate upon the objects in the front, as upon those in the distances; and this want of variety, joined with the feebleness of the masses of shadow, give his engravings, with all their neatness, an unfinished appearance, much unlike the firm substantial effect which we find in the works of Albert Durer. He was attentive to the minutiae of his art. Every thing is carefully made out in his prints, and no part of them is neglected. He gave great character and expression to the heads of his figures; but, on examination of his works, we find the same heads too often repeated. The hands and feet are rather mannered than correct; and when he attempted to draw the naked figure, he succeeded but very indifferently. He affected to make the folds of his draperies long and flowing; but his female figures are frequently too excessively loaded with girdles, bandages, and other ornamental trappings, that much of the elegance of the design is lost. He engraved on wood, as well as on copper; but his works on the former are by no means numerous. They are, however, very spirited; tho' not equal, upon the whole, to those of his friend Albert. The prints of this master are pretty numerous, but very seldom met with complete; especially fine impressions of them. For though they are, generally speaking, executed with the graver only, yet, from the delicacy of the execution, they soon suffered in the printing. Of his engravings the few following may be mentioned as among the principal. 1. *Mahomet sleeping, with a priest murdered by his side, and another figure stealing his sword*, a middling-sized upright plate, dated 1508, said to be one of his most early productions. 2. *An ecce homo*, a large plate, lengthwise, dated 1510. 3. *The crucifixion on Mount Calvary*, the same. 4. *The wife men offering*, the same, dated 1513. 5. *Return of the prodigal son*, a middling-sized plate, lengthwise, dated 1518. 6. A large print lengthwise called *the dance of Magdalen*, dated 1519. 7. *His own portrait*, a small upright plate, dated 1525. 8. *David playing before Saul*, a middling-sized upright plate, dated 1525. This is a very fine print; the expression of Saul's countenance, in particular, is admirable. 9. A print known by the name of *Ulfspiegel*, which is the scarcest of all the works of this master. It is in the collection of the king of France; and said by Marolles, and other masters, to be unique. But Bafan informs us, that M. Mariette had also an impression of this plate; and it has been since found in one or two other collections. It represents a travelling bag-piper with his family; himself playing as he goes along, and carrying two children in a basket at his back; his wife trudging by his side, supporting with one hand an infant on her shoulder, and with the other leading an ass loaded

with two baskets, having two children in each; and another child going before, with a little dog, completes the singular groupe. This rare print is dated 1520, and is known to have been sold for 16 Louis-d'ors.—It is nearly 7½ inches high by 4½ broad; and has been twice copied. One of the copies is the reverse way: but the other is the same way with the original; and though not so well executed, might without a comparison be mistaken for it.

Lucas (Richard), D. D. a learned English divine, was born in 1648, and studied at Oxford: after which he entered into holy orders, and was for some time master of the free school at Abergavenny. Being esteemed an excellent preacher, he became vicar of St Stephen's, Coleman street, in London, and lecturer of St Olave's in Southwark. He was doctor of divinity; and in 1696 was installed prebendary of Westminster. His fight began to fail him in his youth; and he totally lost it in his middle age. He was greatly esteemed for his piety and learning; and published several works, particularly, 1. *Practical Christianity*. 2. *An inquiry after happiness*. 3. *Several sermons*. 4. A Latin translation of the whole duty of man. He died in 1715.

LUCCA, a small republic of Italy on the coast of the Mediterranean, between the territory of Genoa on the west, Modena on the north, and Tuscany on the east. According to Keysser, it is only about 30 miles in circumference, but is exceeding fertile and populous. It contains, besides the city of Lucca, 150 villages. The number of inhabitants are computed at 120,000. The government is lodged in a gonsalonier, whose power is much the same with that of the doges of Venice and Genoa. He is assisted by nine counsellors: but the power of all the ten continues only for two months; during which time they live in the state-palace, and at the public expence. They are chosen out of the great council, which consists of 240 nobles; but even this council is changed by a new election every two years. The revenues of the republic are about 400,000 feudi or crowns; out of which they maintain 500 men by way of regular force, and 70 Swifts as a guard to their acting magistrates. The city of Lucca is situated in a plain, terminating in most delightful eminences, adorned with villas, summer-houses, corn-fields, and plantations of every kind; so that nothing either for use or pleasure is here wanting. The city, which is about three Italian miles in circumference, has regular well-lined fortifications; and its streets, though irregular, are wide, well paved, and full of handsome houses. The number of its inhabitants are computed to be above 40,000; and they carry on large manufactures, especially of silk-stuffs. Lucca has a bishop, who enjoys several extraordinary privileges; and its cathedral is Gothic. The city stands in E. Long. 11. 27. N. Lat. 43. 52.

LUCENTI, LUCENTIA, or *Lucentum*, a town of the Hither Spain, now Alicante, a sea-port of Valencia. W. Long. 32, Lat. 38 37.

LUCERES, in Roman antiquity, the third in order of the three tribes into which Romulus divided the people, including all foreigners; so called from the *lucus* or grove, where Romulus opened an asylum.

LUCERIA (anc. geog.), a town of Apulia in Italy; which in Strabo's time still exhibited marks of Diomedes.

Lucas

Luceria.

Lucerius
||
Lucerne.

Diomed's sovereignty in those parts. Ptolemy has *Nuceria*; whether from mistake, or the custom of his time, uncertain. Now *Nocera de Paganis*, in the kingdom of Naples. E. Long. 15. o. N. Lat. 40. 40.

LUCERIUS, in mythology, a name given to Jupiter, as *Luceria* was given to Juno, as the deities which gave light to the world.

LUCERNE, one of the 13 cantons of Switzerland. It holds the third place among the 13; and is the head of the Catholic cantons. Though less than Zurich, and consequently much less than Berne, it is, however, far more extensive than any of the rest, being 15 or 16 leagues long, and eight broad. The population is estimated at 100,000. Even the mountainous part is not barren, but abundant in wood and pasture, furnishing cattle, hides, cheese, and butter, for exportation. All the north part is fertile in grain, fruit, and hay; supplying sufficient for the consumption of the inhabitants: but as the mountaineers of the little cantons come to their market for corn, the people of Lucerne purchase this commodity from other parts of Switzerland, but especially from Alsace and Suabia. Their manufactures are very inconsiderable; consisting only in a little silk and cotton thread.—The government is oligarchical. The councils are chosen from among 500 citizens only. The great council of 64 members is the nominal sovereign; but in fact the power resides in the senate, or little council of 36, having for their chiefs the two *Avoyers*.—The whole canton professes the Roman Catholic religion. The pope's nuncio, with the title of legate *a latere*, usually resides at Lucerne.—They threw off the Austrian yoke in 1352, and by entering into a perpetual alliance with the three ancient cantons, they gave such weight to the confederacy, as to enable it in 1386 to resist all the efforts of the enemy at the bloody battle of Sempach.

The town of *Lucerne* is situated at the extremity of a most beautiful lake of the same name, where the river Reufs issues from it. The buildings are ancient, and the streets narrow; nor is Lucerne populous in proportion to its extent, the inhabitants being only between 3 and 4,000. Since this is the great passage to Italy by Mount St Gothard, and the merchandize which passes the Alps on mules, and is to be transported by the rivers Reufs, Aar, and Rhine, is all deposited here, it might have a flourishing trade if arts and manufactures were attended to. The Reufs separates the town into two unequal parts, which are connected by three bridges; one wide for carriages; and two narrow covered ones for foot passengers: besides these, there is a fourth over an arm of the lake, to pass to the cathedral. Three of these bridges have old bad paintings of the Dance of Death, and the History of the Bible, and of Switzerland. They make a commodious dry walk for the inhabitants.—Of religious edifices, the principal are the cathedral, or collegiate church of St Leger; the convent of Cordeliers; the college of the Jesuits; the convent of Capuchins; and two convents of nuns. Of the secular buildings, the hotel de Ville is the principal. The arsenal is well furnished. The water tower is remarkable only for its position and antiquity: it is said to have been a pharos or lighthouse.—What greatly attracts most the notice of strangers is, a plan in

relief of part of the cantons of Lucerne, Zug, and Berne, and the whole of Schwiitz, Uri, and Underwald, executed by General Pfisser on a large scale. He has completed about 60 square leagues; the plan is 12 feet long, and nine and a half broad: every mountain is accurately measured; and every object distinctly placed.

The *Lake of Lucerne* exhibits greater variety and more picturesque scenery than any other of the Swiss lakes. It is seven leagues long in a right line, and three wide about Kuffnacht; but the shape is very irregular. The whole south side is bordered by high mountains; but the north exhibits hills of no great height. The narrow gulph that extends towards the west, is bordered on the north and north-west by mount Pilat, which is a single mountain rising boldly more than 6000 feet above the lake; and on the south by mount Burgenberg. Stanz-Stadt, belonging to the canton of Underwald, is on this side; and hereabouts the lake is deepest. Kuffnacht is on the point of the other gulph, which extends towards the east, and is wider than the former. All the country to the west of these gulphs, and part of it to the north of the latter, belongs to the canton of Lucerne; but that which is to the south and north-east is dependant on the canton of Zug. All the mountains on the left shore of the lake belong to the canton of Underwald; those on the right, partly to the canton of Uri, partly to that of Schwiitz, partly to the little republic of Gersau, but principally to the canton of Lucerne.

LUCERNE, in botany. See MEDICAGO.—For the culture of this plant, see AGRICULTURE, n^o 183.

LUCIA (St), one of the Caribbee Islands in the West Indies, about 22 miles long, and 11 broad, the middle of it lying in N. Lat. 39. 14. W. Long. 27. 0. It was first settled by the French in 1650; but was reduced by the English in 1664, who evacuated it in 1666. The French immediately re-settled the island, but were again driven away by the Caribbs. As soon as the savages were gone, the former inhabitants returned, but only for a short time; for being afraid of falling a prey to the first privateer that should visit their coasts, they removed either to other French settlements that were stronger, or which they might expect to be better defended. There was then no regular culture or colony at St Lucia; it was only frequented by the inhabitants of Martinico, who came thither to cut wood, and to build canoes, and who had considerable docks on the island. In 1718 it was again settled by the French; but four years after, it was given by the court of London to the duke of Montague, who was sent to take possession of it. This occasioned some disturbance between the two courts; which was settled, however, by an agreement made in 1731, that, till the respective claims should be finally adjusted, the island should be evacuated by both nations, but that both should wood and water there. This precarious agreement furnished an opportunity for private interest to exert itself. The English no longer molested the French in their habitations; but employed them as their assistants in carrying on with richer colonies a smuggling trade, which the subjects of both governments thought equally advantageous to them. This trade has been more or less considerable till the treaty of 1763, when the

Lucerne,
Lucia.

Lucia,
Lucian.

property of St-Lucia was secured to the crown of France. After that time the colony flourished considerably. In the beginning of the year 1772, the number of white people amounted to 2018 souls, men, women, and children; that of the blacks to 663 freemen, and 12,795 slaves. The cattle consisted of 928 mules or horses, 2070 head of horned cattle, and 3184 sheep or goats. There were 38 sugar plantations, which occupied 978 pieces of land; 5395,889 coffee-trees; 1,321,600 cocoa plants; and 367 plots of cotton. There were 706 dwelling places. The annual revenue at that time was about 175,000 l. which, according to the Abbé Raynal, must have increased one-eighth yearly for some time. It was taken by the British fleet under admirals Byron and Barrington, in the year 1778; but was restored to France at the peace of 1782.

The soil of St Lucia is tolerably good, even at the sea side; and is much better the farther one advances into the country. The whole of it is capable of cultivation, except some high and craggy mountains which bear evident marks of old volcanoes. In one deep valley there are still eight or ten ponds, the water of which boils up in a dreadful manner, and retains some of its heat at the distance of 6000 toises from its reservoirs. The air in the inland parts, like that of all other uninhabited countries, is foul and unwholesome; but grows less noxious as the woods are cleared and the ground laid open. On some parts of the sea-coast, the air is still more unhealthy, on account of some small rivers which spring from the foot of the mountains, and have not sufficient slope to wash down the sands with which the influx of the ocean stops up their mouths, by which means they spread themselves into unwholesome marshes on the neighbouring grounds.

LUCIA (St), a high and mountainous island of Africa, and one of those of Cape Verde, is about nine leagues long, and lies in the latitude of 16° 18' N. according to the English geographers; but according to all others, it is a degree farther to the northward. On the east-fourth-east side is a harbour, with a bottom and shore of white sand; but its best road is opposite to St Vincent's to the south-west, where there are at least 20 fathoms of water. On the west side there is no water: it abounds with goats, sea and land fowls, tortoises, &c. but whether it hath any inhabitants is not certainly known.

LUCIAN, a celebrated Greek author in the first century, was born at Samosata, of obscure parents, in the reign of the emperor Trajan. He studied law, and practised some time as an advocate; but growing weary of the wrangling oratory of the bar, he commenced rhetorician. He lived to the time of Marcus Aurelius, who made him register of Alexandria in Egypt; and, according to Suidas, he was at last worried by dogs. Lucian was one of the finest wits in antiquity. His Dialogues, and other works, are written in Greek. In these he has joined the useful to the agreeable, instruction to satire, and erudition to elegance; and we every where meet with that fine and delicate raillery which characterises the Attic taste.—Those who censure him as an impious scoffer at religion, have reason on their side, if religion consisted in

the theology of the Pagan poets, or in the extravagant opinions of philosophers; for he perpetually throws such ridicule on the gods and philosophers, with their vices, as inspires hatred and contempt for them; but it cannot be said that he writes any where against an over-ruling providence.

LUCIANISTS, or LUCANISTS, a religious sect, so called from Lucianus, or Lucanus, a heretic of the second century, being a disciple of Marcion, whose errors he followed, adding some new ones to them. Epiphanius says he abandoned Marcion; teaching that people ought not to marry, for fear of enriching the Creator: and yet other authors mention that he held this error in common with Marcion and other Gnostics. He denied the immortality of the soul; asserting it to be material.

There was another sect of Lucianists, who appeared some time after the Arians. They taught, that the Father had been a Father always, and that he had the name even before he begot the Son; as having in him the power or faculty of generation; and in this manner they accounted for the eternity of the Son.

LUCID INTERVALS, the fits of lunatics or maniacs, wherein the phrenzy leaves them in possession of their reason.

LUCIFER, according to the poets, was the son of Jupiter and Aurora: in astronomy, Lucifer is the bright planet Venus, which either goes before the sun in the morning, and is our morning star; or in the evening follows the sun, and then is called *Hesperus* or the evening star.

LUCIFERA, in mythology, a surname given to Diana, under which title she was invoked by the Greeks in childbirth. She was represented as covered with a large veil, interspersed with stars, bearing a crescent on her head, and holding in her hand a lighted flambeau.

LUCIFERIAN, a religious sect, who adhered to the schism of Lucifer, bishop of Cagliari, in the fourth century, who was banished by the emperor Constantius for having defended the Nicene doctrine concerning the three persons in the godhead.—St Augustine seems to intimate, that they believed the soul, which they considered as of a carnal nature, to be transmitted to the children from their fathers. Theodoret says, that Lucifer was the author of a new error. The Luciferians increased mightily in Gaul, Spain, Egypt, &c. The occasion of the schism was, that Lucifer would not allow any acts he had done to be abolished. There were but two Luciferian bishops, but a great number of priests and deacons. The Luciferians bore a peculiar aversion to the Arians.

LUCILIUS (Caius), a Roman knight, and a Latin poet, was born at Suessa in Italy, about 140 B. C. He served under Scipio Africanus in the war with the Numantines; and was in great favour with that celebrated general, and with Lælius. He wrote 30 books of satires, in which he lashed several persons of quality very sharply. Some learned men ascribe the invention of satire to him; but M. Dacier has maintained, with great probability, that Lucilius only gave a better turn to that kind of poetry, and wrote it with more wit and humour than his predecessors Ennius and Pacuvius had done. His fragments have been carefully collected.

Lucianus
Lucilius.

collected by Francis Douar at Leyden in 1599, with notes. But they require still to be better illustrated by some learned critic.

LUCINA, a goddess among the Romans, who presided over women in labour. Some take her to be Diana, others Juno. She is called *Lucina*, because she brought children to the light; from the Latin word *lux*, "light."

LUCIUS, in ichthyology. See *ESOX*.

LUCONIA. See *MANILA*.

LUCOPHEREA, in ichthyology. See *PERCA*.

LUCRETIA, the famous Roman matron, wife of Collatinus, and the cause of the revolution in Rome from a monarchy to a republic: this lady being ravished by Sextus, the eldest son of Tarquin king of Rome, stabbed herself, 509 B.C. See the article *CHASTITY*. The bloody poinard, with her dead body exposed to the senate, was the signal of Roman liberty; the expulsion of the Tarquins, and abolition of the regal dignity, was instantly resolved on, and carried into execution. See *ROME*.

LUCRETIVS, or TITUS LUCRETIVS CAIUS, one of the most celebrated of the Latin poets, was born of an ancient and noble Roman family, and studied at Athens, where he became one of Epicurus's sect. He acquired great reputation by his learning and eloquence; but in the flower of his age fell into a frenzy, occasioned by a philtre given him by his wife, who was distractedly fond of him. Lucretius, during the intervals of his madness, put Epicurus's doctrines into verse, and composed his six books *De rerum natura*, which are still extant. It is said that he killed himself in a fit of madness, in the 54th year before the Christian era, when 51 years old. The most correct edition of Lucretius is that of Simon de Coline. The cardinal de Polignac has refuted Lucretius's arguments in his excellent Latin poem intitled *Anti-Lucretius*. His poem *De rerum natura* has been translated into English by Mr Creech.

LUCRINUS LACUS (anc. geog.), a lake of Campania, between Baiæ and Puteoli, famous for its oysters (Horace, Martial, Juvenal); *Lucrinenses* (Cicero), the people dwelling on it. Now a perfect bay since the earthquake in 1538.

LUCULLUS (Lucius Lucinius), a Roman general, celebrated for his eloquence, his victories, and his riches. In his youth he made a figure at the bar; and being afterwards made questor in Asia, and prætor in Africa, governed those provinces with great moderation and justice. Scarce he was known as a military man, when he twice beat the fleet of Amilcar, and gained two great victories over him. His happy genius was greatly improved by study; for he employed his leisure in reading the best authors on military affairs. Being made consul with Aurelius Cotta, during the third war with Mithridates king of Pontus, he was sent against this prince: and this expedition was attended with a series of victories, which did him less honour than an act of generosity towards his colleague; who, willing to take advantage of his absence to signalize himself by some great exploit, hastened to fight Mithridates; but was defeated and shut up in Calchedonia; where he must have perished, if Lucullus, sacrificing his resentment to the pleasure of saving a Roman citizen, had not flown to his assistance, and

Nº 188.

disfigured him. All Pontus then submitted to Lucullus; who being continued in his government of Asia, entered the territories of Tigranes, the most powerful king in Asia. That prince marched with a formidable army against Lucullus: who defeated him with a handful of men, and killed great numbers of his forces; took Tigranocertes, the capital of his kingdom; and was ready to put an end to the war, when the intrigues of a tribune got him deposed, and Pompey nominated in his room. Lucullus having brought home prodigious riches, now gave himself up to excessive luxury; and his table was served with a profusion till that time unknown. He brought from the East a great number of books, which he formed into a library, and gave admittance to all men of learning, who frequented it in great numbers. Toward the end of his life, he fell into a kind of madness; and Lucullus, his brother, was appointed his guardian. He is said to have been the first who brought cherries into Europe, having brought the grafts from the kingdom of Pontus.

LUCUS, in general, denotes a wood or grove sacred to a deity; so called *à lucendo*, because a great number of lights were usually burning in honour of the god (Indorus); a practice common with idolaters, as we learn from Scripture: hence Homer's *ὄλυσσεν ἄλυσον*.

LUD, a British word mentioned in our old chronicles, and said to have reigned about the year of the world 3878. He is reported to have enlarged and walled about *Troynewton*, or New Troy, where he kept his court, and made it his capital. The name of *London* is hence derived from *Lud's town*; and *Ludgate*, from his being buried near it: but this is only one among many other derivations of the name of London; which are at least equally probable. See *LONDON*.

LUDI, a term used for shows and public representations made by the Romans, for the entertainment of the people. See *GAMES*.

For an account of the particular games of Greece and Rome, as the Isthmian, Nemean, Olympic, &c. see *ISTHMIAN*, &c.

LUDIUS, a celebrated painter, lived in the reign of Augustus Cæsar, and excelled in grand compositions. He was the first who painted the fronts of houses in the streets of Rome; which he beautified with great variety of landscapes, and many other different subjects.

LUDLOW (Edmund), son of Sir Henry Ludlow was born at Maidenhead, and educated in Trinity college, Oxford. His father opposing the king's interest, Mr Ludlow joined with the same party, and was present at the battle of Edgehill as a volunteer under the earl of Essex. Upon the death of his father, he was chosen knight of the shire for Wilts, and obtained the command of a regiment of horse for the defence of that county. He was one of King Cha. I's judges: after whose death he was sent by the parliament into Ireland, in quality of lieutenant-general of the horse; which employment he discharged with diligence and success till the death of the lord-deputy Ireton, when he acted for some time as general, though without that title; Cromwell, who knew him to be sincerely in the interest of the commonwealth, always finding out some pretext to hinder the conferring of that character upon him. The last stroke had been given

Ludlow.

given by Ludlow to the Irish rebellion, if the usurpation of Cromwell not prevented it. Under his power he never acted; and though Cromwell used his utmost efforts, he remained inflexible. After Cromwell's death, he endeavoured to restore the commonwealth; but Charles II. being recalled, he thought proper to conceal himself, and escaped into Switzerland, where he settled. After the revolution, he came over into England, in order to be employed in Ireland against King James: but appearing publicly in London, it gave great offence; and an address was presented by Sir Edward Seymour to King William III. for a proclamation in order to apprehend Colonel Ludlow, attainted for the murder of King Charles I. Upon this he returned to Switzerland, where he died. During his retirement in Switzerland he wrote his Memoirs.

LUDLOW, a town of Shropshire in England, situated at the conflux of the Teme and Corve, 18 miles from Shrewsbury, and 138 from London. The president of the council of the marches, established by Henry VIII. generally kept his courts in it, by which the town was much benefited, these courts not having been abolished till the reign of William and Mary. Its neighbourhood to Wales makes it a great thoroughfare, and engages many of the Welch to send their children of both sexes to it for education. It was incorporated by Edward IV. and among other privileges has that of trying and executing criminals within itself. It is one of the neatest towns in England, with walls and seven gates. It is divided into four wards; and is governed by 2 bailiffs, 12 aldermen, 25 common-councillors, a recorder, a town-clerk, steward, chamberlain, coroner, &c. From the castle on the top of the hill on which the town stands is a most delightful prospect. In an apartment of the outer gatehouse Samuel Butler is said to have written the first part of Hudibras. Of this castle, which was besieged and taken by King Stephen, some of the offices are fallen down, and great part of it turned into a bowling-green; but part of the royal apartments and the sword of state are still left. The walls were at first a mile in compass, and there was a lawn before it for near two miles, of which much is now inclosed. The battlements are very high and thick, and adorned with towers. It has a neat chapel, where are the coats of arms of abundance of Welch gentry, and over the stable-doors are the arms of Queen Elizabeth, the earls of Pembroke, &c. This castle was a palace of the prince of Wales, in right of his principality. The river Teme has a good bridge over it, several wears across it, and turns a great many mills. Here is a large parochial church, which was formerly collegiate; in the choir whereof is an inscription relating to Prince Arthur, elder brother to King Henry VIII. who died here, and whose bowels were here deposited, though it is said his heart was taken up some time ago in a leaden box. In this choir is a closet, commonly called *God's House*, where the priests used to keep their consecrated utensils; and in the market-place is a conduit, with a long stone cross on it, and a niche wherein is the image of St Laurence, to whom the church was dedicated. On the north side of the town there was a rich priory, whereof there are few ruins to be seen except those of its church. Here are an alms-house for

30 poor people, and two charity-schools where 50 boys and 30 girls are both taught and clothed. It has a market on Monday, and three lesser ones on Wednesday, Friday, and Saturday. Its fairs are on the Tuesday Easter, Whit-Wednesday, August 21. Sept. 28. and Dec. 8. Provisions are very cheap here; and at the annual horse-races there is the best of company. The country round is exceedingly pleasant, fruitful, and populous, especially that part called the *Corvedale*, being the vale on the banks of the river Corve. Ludlow sends two members to parliament.

LUDOLPH (Job), a very learned writer of the 17th century, was born at Erfurt in Thuringia. He travelled much, and was master of 25 languages; visited libraries, searched after natural curiosities and antiquities every where, and conversed with learned men of all nations. He published *A History of Ethiopia*, and other curious books.

LUDOLPH (Henry William), nephew of Job above-mentioned, was born at Erfurt in 1655. He came over to England as secretary to M. Lenthoe, envoy from the court of Copenhagen to that of London; and being recommended to Prince George of Denmark, was received as his secretary. He enjoyed this office for some years, until he was incapacitated by a violent disorder; when he was discharged with a handsome pension: after he recovered, he travelled into Muscovy, where he was well received by the czar, and where his knowledge made the Muscovite priests suppose him to be a conjuror. On his return to London in 1694, he was cut for the stone; and as soon as his health would permit, in acknowledgment of the civilities he had received in Muscovy, he wrote a grammar of their language, that the natives might learn their own tongue in a regular method. He then travelled into the East, to inform himself of the state of the Christian church in the Levant; the deplorable condition of which induced him, after his return, with the aid of the bishop of Worcester, to print an edition of the New Testament in the vulgar Greek, to present to the Greek church. In 1709, when such numbers of Palatines came over to England, Mr Ludolph was appointed by Queen Anne one of the commissioners to manage the charities raised for them; and he died early the following year. His collected works were published in 1712.

LUDWIGIA, in botany: A genus of the monogynia order, belonging to the tetrandria class of plants; and in the natural method ranking under the 17th order, *Calycanthemae*. The corolla is tetrapetalous; the calyx quadripartite, superior; the capsule tetragonal, quadrilocular, inferior, and polyspermous.

LUES, among physicians, is in general used for a disease of any kind; but in a more particular sense is restrained to contagious and pestilential diseases: thus the *lues Gallica*, or *venerea*, signifies the venereal disease. See *MEDICINE-Index*.

LUFF, the order from the pilot to the steersman to put the helm towards the *lee-side* of the ship, in order to make the ship sail nearer the direction of the wind. Hence, luff round, or luff a-lee, is the excess of this movement, by which it is intended to throw the ship's head up in the wind, in order to tack her, &c. A ship is accordingly said to spring her luff when she yields to the effort of the helm, by sailing

Ludolph

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Luff.

Luff
||
Luke.

nearer to the line of the wind than she had done before. See also *HAULING the Wind*.

Luff-Tackle, a name given by sailors to any large tackle that is not defined for a particular place, but may be variously employed as occasion requires. It is generally somewhat larger than the jigger tackle, although smaller than those which serve to hoist the heavier materials into and out of the vessel, which latter are the main and fore-tackles, the stay and quarter-tackles, &c.

LUG-SAIL, a square-sail, hoisted occasionally on the mast of a boat or small vessel upon a yard which hangs nearly at right angles with the mast. These are more particularly used in the *barca longas*, navigated by the Spaniards in the Mediterranean.

LUGDUNUM (anc. geog.), the capital of the Segusiiani in Gallia Celtica, situated at the conflux of the Arar and Rhodanus, on an eminence, as the Celtic term *dune* signifies; built by Manutius Plancus under Augustus, while commanding in that part of Gaul; and whither he led a colony. Now *Lyons*, capital of the Lyonois.

LUGDUNUM Batavorum (anc. geog.), a town of the Batavi in Gallia Belgica. Now *Leyden* in Holland.

LUGDUNUM Conserarum (anc. geog.), a town of Gaul in Aquitain, at the foot of the Pyrenees. Now *S. Bertrand*, in Gascony.

LUCEUS LACUS (anc. geog.), a lake of Japydia, the westmost district of Illyricum, to the south of the Save, and near the head of the Arsa. Now commonly called the *Zirichnitz Lake*, from a small adjoining town. It is locked on every side with mountains; from which scanty currents run down; the less in quantity their waters, because drank up by the earth; till at length they are swallowed up in rocky furrows, so formed as to resemble artificial. In these the water being so redundant as to refuse receiving any more, they regurgitate, and return the water with extraordinary celerity; which thus spreading itself, forms a lake, in most places 18 cubits high. These waters afterwards retire with no less celerity than they came on, not only through the furrows, but pass through the whole of the bottom, as through a sieve; which when perceived by the inhabitants, they directly stop up the larger apertures, and thus take large quantities of fish: when the lake is dry, they cut down their harvest on the spot where they fished, and flow again before the inundation comes on: and grass shoots so quick on it, that it may be cut down in three weeks time (*Lazius*, *Wernherus*).

LUGGERSHALL, a borough of Wiltshire, 12 miles north of Salisbury, and 7½ north by west of London. It is an ancient borough by prescription, though but a small hamlet, near the forest of Chute, in a delightful country; and was the residence of several kings. It had formerly a castle. It is governed by a bailiff chosen yearly at the lord of the manor's court-leet. On the neighbouring downs there used to be horse-races. It has a fair on the 25th of July, and sends two members to parliament.

LUKE (St), the evangelist, and the disciple of the apostles, was originally of Antioch in Syria, and by profession a physician. He particularly attached himself to St Paul, and was his faithful companion in his travels and labours. He went with him to Troas in Macedonia about the year 51. He wrote his Gospel

Luke
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Lumbricus

in Achaia about the year 53; and, ten years after, the Acts of the Apostles, which contains a history of 30 years. Of all the inspired writers of the New Testament, his works are written in the most elegant Greek. It is believed that St Luke died at Rome, or in Achaia.

Gospel of St Luke, a canonical book of the New Testament. Some think that it was properly St Paul's Gospel; and that, when the apostle speaks of *his Gospel*, he means what is called *St Luke's*. Irenæus says, that St Luke digested into writing what St Paul preached to the Gentiles; and Gregory Nazianzen tells us, that St Luke wrote with the assistance of St Paul.

St Luke the Evangelist's Day, a festival in the Christian church, observed on the 18th of October.

LULA, a town of Swedish Lapland; seated at the mouth of the river Lula, on the west side of the gulph of Bothnia, 42 miles south-west of Tornea. E. Long. 21.0. N. Lat. 64.30.

LULA Lapmark, a province of Swedish Lapland; bounded by that of Tornea on the north, by the Bothnic Gulph on the east, by Pithia Lapmark on the south, and Norway on the west.

LULLI (John Baptist), the most celebrated and most excellent musician that has appeared in France since the revival of learning, was born at Florence. He was taken to France when very young by a person of quality; and he carried the art of playing on the violin to the highest perfection. Louis XIV. made him superintendent of music. Some time after Perinna having introduced operas into France, and quarrelling with his company, he resigned his privilege to Lulli. Operas were then carried to the utmost perfection by this celebrated musician, and were attended with continual applause. Lulli every year, after this time, gave a piece of his own composition, till his death, which happened in 1687.

LULLY (Raymond), a famous writer, surnamed the *Enlightened Doctor*, was born in the island of Majorca in 1225. He applied himself with indefatigable labour to the study of the Arabian philosophy, to chemistry, physics, and divinity; and acquired great reputation by his works. He at length went to preach the gospel in Africa; and was stoned to death in Mauritania, at the age of 80. He is honoured as a martyr at Majorca, whither his body was carried. He wrote many treatises on all the sciences, in which he shows much study and subtilty, but little judgment or solidity. A complete edition of his works has been printed at Mentz.—He ought not to be confounded with Raymond Lully of Terraca, surnamed *Nephtya*, who from being a Jew turned Dominican friar. This last Lully maintained several opinions that were condemned by Pope Gregory XI.

LUMBAGO, a fixed pain in the small of the back. See *MEDICINE-Index*.

LUMBARIS, a name given to the arteries and veins which spread over the loins.

LUMBRICAL, a name given to four muscles of the fingers and to as many of the toes.

LUMBRICUS, the *Worm*, in zoology; a genus of insects belonging to the order of vermes intestina. The body is cylindrical, annulated, with an elevated belt near the middle, and a vent-hole on its side. There are two species of this animal.

Lumbricus
Luminous.

1. *Lumbricus terrestris*, the earth or dew worm, Mr Barbut observes, differs extremely in colour and external appearance in the different periods of its growth, which has occasioned people little acquainted with the variations of this kind of animals to make four or five different species of them: The general colour is a dusky red.—They live under ground, never quitting the earth but after heavy rains or at the approach of storms, and in the season of their amours. The method to force them out is, either to water the ground with infusions of bitter plants, or to trample on it. The bare motion on the surface of the soil drives them up, in fear of being surprized by their formidable enemy the mole. The winding progression of the worm is facilitated by the inequalities of its body, armed with small, stiff, sharp-pointed bristles: when it means to insinuate itself into the earth, there oozes from its body a clammy liquor, by means of which it slides down. It never damages the roots of vegetables. Its food is a small portion of earth, which it has the faculty of digesting: The superfluity is ejected by way of excrement, under a vermicular appearance. Earth-worms are hermaprodites, and have the parts of generation placed near the neck: their copulation is performed on the ground; nothing being more usual than to see it full of holes, which holes are thought to be made by those kind of worms coming to the surface in quest of females. During their coition they would sooner suffer themselves to be crushed than parted.

Plate
ICLXXIV

2. The marinus, marine worm, or lug, is of a pale red colour, and the body is composed of a number of annular joints; the skin is scabrous, and all the rings or joints are covered with little prominences, which render it extremely rough to the touch. It is an inhabitant of the mud about the sea shores, and serves for food to many kinds of fish: surprizing large ones are to be met with about the Boggor rocks in Sussex. The fishermen bait their hooks and nets with it.

For the effects of these animals in the human body, and the method of expelling them, see *MEDICINE-Index*.

LUMELLO, a village in Italy, which gives name to the Lumellin, a small district in the duchy of Milan, lying along the river Po, and of which Mortaria and Valencia are the principal places. It was ceded to the duke of Savoy in 1707, and confirmed by the treaty of Utrecht in 1713. E. Long. 8.42. N. Lat. 45.5.

LUMINOUS, an epithet applied to any thing that shines or emits light.

LUMINOUS Emanations, have been observed from human bodies, as also from those of brutes. The light arising from currying a horse, or from rubbing a cat's back, are known to most. Instances of a like kind have been known on combing a woman's head. Bartholin gives us an account, which he intitles *mulier splendens*, of a lady in Italy whose body would shine whenever slightly touched with a piece of linen. These effluvia of animal bodies have many properties in common with those produced from glass; such as their being lucid, their snapping, and their not being excited without some degree of friction; and are undoubtedly electrical, as a cat's back has been found strongly electrical when stroked. See *ELECTRICITY*, and *LIGHT*.

LUMINOUSNESS OF THE SEA. See *LIGHT*, *Luminousness*, and *SEA*.

LUMINOUSNESS of Putrescent Substances. See *LIGHT*. *LUMP-FISH*. See *CYCLOPTEPUS*.

LUNA (anc. geog.), a forest of Germany, at no great distance from the Hercynia; below which were the Boemi: it was therefore in Moravia, near the springs of the Marus, now March, which runs into the Danube over against Carnatum.

LUNA, or *Lunna*, a town of Gallia Celtica. Now *Clugny* in Burgundy.

LUNA, a town and port of Liguria, at the mouth of the Macra. The town was but small, but the port large and beautiful, according to Strabo. Now extinct, and its ruins called *Luna Distrutta*. It was famous for its quarries of white marble, thence called *Lunenfe*; and for its cheefe, remarkable rather for its size than goodness, each being a thousand weight.

LUNA, in astronomy, the moon. See *ASTRONOMY*, *passim*.

LUNA, in the jargon of the alchemists, signifies *silver*; so called from the supposed influence of the moon thereupon.

LUNA Cornea, in chemistry, is the combination of marine acid with silver. See *CHEMISTRY-Index*.

LUNACY, a species of madness. See *LUNATIC*, and *MEDICINE-Index*.

LUNACY, in law. See *IDIOTCY*, and *LUNATIC*.

LUNÆ MONS (anc. geog.), a promontory of Lusitania. Now *Rock of Lisbon*. W. Long. 10. N. Lat. 38.50.—Another *Luna Mons* of Ethiopia, from which the Nile was supposed to take its rise.

LUNÆ Portus, a very extensive port, or more truly a bay, of Liguria, between *Portus Veneris* and *Portus Erisis*, 20 miles in compass. Now *il Golfo della Spezia*, on the east coast of the territory of Genoa.

LUNAR, something relating to the MOON.

LUNAR Month. See *MONTH*.

LUNAR Year, consists of 354 days, or 12 synodical months. See *YEAR*.

LUNAR Dial. See *DIALLING*.

LUNARE OS, in anatomy, is the second bone in the first row of the carpus. It has its name from the Latin, *luna* "the moon," because one of its sides is in form of a crescent.

LUNARIA, *SATTIN-FLOWER*, or *Moonewort*, in botany: A genus of the filiculosa order, belonging to the tetradynamia class of plants; and in the natural method ranking under the 39th order, *Siliqueae*. The filicula is entire, elliptical, compressed-plane, and pedicelled; with the valves equal to the partition, parallel and plane; the leaves of the calyx are alternately fritted at the base. This plant is famous in some parts of the kingdom for its medicinal virtues, though it has not the fortune to be received in the shops. The people in the northern countries dry the whole plant in an oven, and give as much as will lie on a shilling for a dose twice a-day in hemorrhages of all kinds, particularly in the too abundant flowing of the menses, and with great success. The Welch, among whom it is not uncommon, Dr Needham informs us, make an ointment of it, which they use externally, and pretend it cures dysenteries.

LUNARIUM (anc. geog.), a promontory of the Hither Spain, between Blanda and Batulo. Commonly

Lunatic.

monly called *el Cabo de Palafuel*, in Catalonia, on the Mediterranean; or *Cabo de Teſa*, on the ſame coaſt, and in Catalonia, 15 miles from the former, to the weſt.

LUNATIC, a perſon affected with that ſpecies of madneſs termed *lunacy*. The word is indeed properly applied to one that hath lucid intervals; ſometimes enjoying his ſenſes, and ſometimes not; and that frequently ſuppoſed to depend on the influence of the moon.

LUNATIC, in law. Under the general term of *non compos mentis* (which Sir Edward Coke ſays is the moſt legal name) are comprized not only lunatics, but perſons under frenzies, or who loſe their intellects by diſeaſe; thoſe that *grow* deaf, dumb, and blind, not being *born* ſo; or ſuch, in ſhort, as are judged by the court of chancery incapable of conducting their own affairs. To theſe alſo, as well as idiots, the king is guardian, but to a very different purpoſe. For the law always imagines, that theſe accidental miſfortunes may be removed; and therefore only conſtitutes the crown a truſtee for the unfortunate perſons, to protect their property, and to account to them for all profits received, if they recover, or after their deceaſe to their representatives. And therefore it is declared by the ſtatute 17 Edw. II. c. 10. that the king ſhall provide for the cuſtody and ſuſtentation of lunatics, and preſerve their lands, and the profits of them, for their uſe when they come to their right mind; and the king ſhall take nothing to his own uſe: and if the parties die in ſuch eſtate, the reſidue ſhall be diſtributed for their ſouls by the advice of the ordinary, and of courſe (by the ſubſequent amendments of the law of adminiſtrations) ſhall now go to their executors or adminiſtrators.

On the firſt attack of lunacy, or other occaſional infamy, when there may be hopes of a ſpeedy reſtitution of reaſon, it is uſual to confine the unhappy objects in private cuſtody under the direction of their neareſt friends and relations: and the legiſlature, to prevent all abuſes incident to ſuch private cuſtody, hath thought proper to interpoſe its authority, by 14. Geo. III. c. 49. for regulating private mad-houſes. But when the diſorder is grown permanent, and the circumſtances of the party will bear ſuch additional expence, it is thought proper to apply to the royal authority to warrant a laſting confinement.

The method of proving a perſon *non compos* is very ſimilar to that of proving him an idiot. The lord chancellor, to whom, by ſpecial authority from the king, the cuſtody of idiots and lunatics is intruſted, upon petition or information, grants a commiſſion in nature of the writ *de idiota inquirendo*, to inquire into the party's ſtate of mind; and if he be found *non compos*, he uſually commits the care of his perſon, with a ſuitable allowance for his maintenance, to ſome friend, who is then called his committee. However, to prevent ſiniſter practices, the next heir is ſeldom permitted to be of this committee of the perſon; becauſe it is his intereſt that the party ſhould die. But, it hath been ſaid; there lies not the ſame objection againſt his next of kin, provided he be not his heir; for it is his intereſt to preſerve the lunatic's life, in order to increaſe the perſonal eſtate by ſavings, which he or his family may hereafter be entitled to enjoy. The heir

is generally made the manager or committee of the eſtate, it being clearly his intereſt by good management to keep it in condition; accountable, however, to the court of chancery, and to the *non compos* himſelf, if he recovers; or otherwiſe, to his adminiſtrators. See IDIOT.

LUNATION, the period or ſpace of time between one new moon and another; alſo called *ſynodical month*. See CYCLE and EPOCH.

LUNDEN, or LUND, a conſiderable town of Sweden, in Gothland; and capital of the territory of Schonen, with an archbiſhop's ſee and an univerſity. It was ceded to the Swedes by the Danes in 1658. E. Long. 13. 25. N. Lat. 55. 40.

LUNDY ISLAND, ſituated 50 miles in the ſea, off the N. W. coaſt of Devonſhire, is 5 miles long and 2 broad, but ſo encompassed with inacceſſible rocks, that it has but one entrance to it, ſo narrow that two men can ſcarce go abreſt. It is reckoned in the hundred of Branton. It had once both a fort and a chapel. The fourth part of it is indifferent good ſoil, but the north part of it is barren, and has a high pyramidal rock called the Conſtable. Here are horſes, kine, hogs, and goats, with great ſtore of ſheep and rabbits; but the chief commodity is ſowl, with which it abounds much, their eggs being very thick on the ground at their ſeaſon of breeding. No venomous creature will live in this iſland. In the reign of King Henry VIII. one William Morico, who had conſpired to murder him at Woodſtock, fled to this iſland, which he fortified, turned pirate, and did much damage to this coaſt, but was taken by ſurprize at length, with 16 of his accomplices, and put to death.

LUNE, LUNULA, in *Geometry*, a plane in form of a cresent or half-moon, terminated by the circumference of two circles, that interſect each other within.

LUNENBURG, or LUNEBURG *Zell*, a principality of Germany, bounded to the ſouth by that of Calenberg, the dioceſe of Hildelheim, and the duchy of Brunſwic; to the north, by the duchy of Lauenburg and the Elbe, by the laſt of which it is ſeparated from the territory of the imperial city of Hamburg; to the eaſt, by the duchy of Brunſwic, the Alte Mark, and the duchy of Mecklenburg; and to the weſt, by the duchies of Bremen and Verden, the county of Hoya, and the principality of Calenberg. The ſoil, except along the Elbe, Aller, and Jetz, is either ſand, heath, or moors. In the more fruitful parts of it are produced wheat, rye, barley, oats, peafe, buck wheat, flax, hemp, hops, pulſe, oak, beech, fir, pines, birch, and alder, together with black cattle and horſe. The heaths abound with bees and honey, and a ſmall kind of ſheep whoſe wool is long and coarſe. Lunenburg is well furniſhed with falt ſprings and liſtneſtone, and the foreſt of Gorde with veniſon. The rivers Elbe, Ilmenau, and Aller, are navigable; and conſequently very advantageous to the country, independent of the fiſh which they yield. The general diets of this principality are convened by the ſovereign twice a year, and held at Zell. They conſiſt of the deputies of the nobility and the towns of Lunenburg, Uelzen, and Zell, who have the nomination of the members of the high colleges, and other officers, jointly with the ſovereign.

Lunation
Lunenburg

LUNENBURG reigns. There are near 200 Lutheran churches in the country, under two general and 15 subordinate superintendents; several grammar-schools, two Calvinist churches at Zell, and an academy of exercises at Lunenburg. The manufactures are chiefly linen cloth, cottons, ribbons, stockings, hats, starch, bleached wax, refined sugar, gold and silver wires, all kinds of wooden wares, barges, boats, and ships. The exports of these to Hamburg, Lubec, and Altena, are considerable. The neighbourhood of these cities, with the facility of conveying goods and merchandize to them and other places, either by land or water, is very advantageous to this country, and contributes greatly to its subsistence. On account of this principality, the king of Great Britain has a seat and voice both in the college of the princes of the empire and of the circle of Lower Saxony. Its quota in the Matricula is 20 horses and 120 foot, or 720 florins in lieu of them. The revenues of the principality arise chiefly from the demesnes, tolls on the Elbe, contributions, duties on cattle, beer, wine, brandy, and other commodities, which all together must be very considerable, some bailiwicks alone yielding upwards of 20,000 rix-dollars.

LUNENBURG, the capital of the principality of the same name, is a pretty large town of Germany, on the river Elmen, or the Ilmenau, which is navigable from the town to the Elbe, at the distance of 13 miles. It is 27 miles from Hamburg, 43 from Zell, 65 from Brunswick, 76 from Bremen, 68 from Hanover; and stands in E. Long. 10. 40. N. Lat. 53. 28. Its inhabitants are reckoned at between 8000 and 9000. Formerly this town was one of the Hanse, and an imperial city. Some derive its name from *Lina*, the ancient name of the Ilmenau; others from *Luna*, the moon, an image of which is said to have been worshipped by the inhabitants in the times of Paganism. Here were anciently several convents, viz. one of Minims, another of Prémonstratensians, another of Benedictines, and a fourth of Minorites. Out of the revenues of the Benedictine monastery was founded an academy for the martial exercises, where young gentlemen of the principality of Lunenburg are maintained gratis, and taught French, fencing, riding, and dancing; but foreigners are educated at a certain fixed price. A Latin school was also founded, consisting of four classes, and well endowed out of these revenues. The superintendency and management of these, and the estates appropriated to their maintenance, belongs to the landschaft director, and the aufseiter, who are both chosen from among the Lunenburg nobility. The first came in place of the Popilish abbot, and as such is head of the states of the principality, and president of the provincial college. He has the title of *excellency*; and in public instruments styles himself, *by the grace of God landschaft director, and lord of the mansion of St Michael in Lunenburg*. The chief public edifices are three parish-churches, the ducal palace, three hospitals, the town-house, the salt-magazine, the anatomical theatre, the academy; the conventual church of St Michael, in which lie interred the ancient dukes; and in which is the famous table eight feet long, and four wide, plated over with chased gold, with a rim embellished with precious stones, of an immense value, which was taken from the Saracens

by the emperor Otho, and presented to this church; but in 1698, a gang of thieves stripped it of 200 rubies and emeralds, together with a large diamond, and most of the gold, so that at present but a small part of it remains. Here are some very rich salt-springs. Formerly, when there was a greater demand for the salt, upwards of 120,000 tons have been annually boiled here, and sold off: but since the commencement of the present century, the salt trade hath declined greatly. A fifth of the salt made here belongs to the king, but is farmed out. It is said to excel all the other salt made in Germany. This town is well fortified; and has a garrison, which is lodged in barracks. In the neighbourhood is a good limestone quarry; and along the Ilmenau are ware-houses, in which are lodged goods brought from all parts of Germany, to be forwarded by the Ilmenau to Hamburg, or by the Asche to Lubec, from whence other goods are brought back the same way. The town itself drives a considerable traffic in wax, honey, wool, flax, linen, salt, lime, and beer.

LUNENSE MARMOR, in the natural history of the ancients, the name of that species of white marble now known among us by the name of the *Carrara-marbles*, and distinguished from the statuary kind by its greater hardness and less splendour. It was ever greatly esteemed in building and ornamental works, and is so still. It is of a very close and fine texture, of a very pure white, and much more transparent than any other of the white marbles. It has always been found in great quantities in Italy, and is so to this day. See **LUNA**.

LUNETTE, in fortification, an enveloped counter-guard, or elevation of earth, made beyond the second ditch, opposite to the places of arms; differing from the ravelins only in their situation. *Lunettes* are usually made in ditches full of water, and serve to the same purpose as sauthebrays, to dispute the passage of the ditch. See **FORTIFICATION**.

LUNETTE, in the manege, is a half horse-shoe, or such a shoe as wants the sponge, *i. e.* that part of the branch which runs towards the quarters of the foot.

LUNETTE is also the name of two small pieces of felt, made round and hollow, to clap upon the eyes of a vicious horse that is apt to bite, and strike with his fore-feet, or that will not suffer his rider to mount him.

LUNGS, in anatomy, a part of the human body, serving for respiration. See **ANATOMY**, n^o 117.

In the *Journal de Médecine* for June 1789 is a description of an

Instrument for Inflating the Lungs, invented by M. Gorcey physician to the military hospital at Neufbrack, which appears to be extremely well adapted to the purpose, whilst it may be used with the greatest ease and facility.

This instrument, which the inventor styles *apodictic*, that is, "reitorer of respiration," consists of a double pair of bellows, BCLM, fig. 1, the two different parts of which have no communication with each other. In the lower side B M, is an aperture A for a valve constructed on the principles of those of Mr Nairne's air-pump. It consists of a rim of copper, closed at one end by a plate of the same metal, in which plate are seven small holes placed at equal distances. This plate

Lunense
Lungs.

Plate
In CCLXXV.

Lungs,
Lunula.

is covered with a piece of silk coated with elastic gum, in which are six transverse incisions of two or three lines in length. Each incision is so made as to be situated between two of the holes, and at an equal distance from each: see D, fig. 2. The silk must be made very secure, by a thread passing several times round the rim. It is obvious, that a stream of air applied to that side of the plate which is opposite the silk, will pass through the holes, and, lifting up the silk, escape through the incisions. On the contrary, a stream of air applied to the other side will press the silk upon the plate, and thus close the holes, so that it will be impossible for it to pass through them. This valve opens internally, so as to admit the air from without. At B is another valve, on the same construction, but opening in a contrary direction, thus permitting the air to escape out of the lower part into the tube E F, but preventing its entrance. At C is another valve, opening internally to admit the air from the tube E F; and at D there is a fourth, opening externally, to discharge the air from the upper part.

The flexible tube E F, screwed on at the end C B, being introduced into one of the nostrils, whilst the mouth and the other nostril are closed by an assistant, if we separate the two handles L M, which were close together at the introduction of the tube, it is evident, that the air in the lungs will rush into the upper part through the valve C, whilst the external air will fill the lower part through the valve A: the two handles being again brought into contact, the atmospheric air will be forced into the lungs through the valve B, and at the same time the air in the upper part will be discharged at the valve D. Thus by the alternate play of the double bellows, the lungs will be alternately filled and emptied as in respiration. In using the instrument care should be taken not to be too violent; as the more perfectly the natural motion of respiration is imitated the better.

To prevent any substances from without injuring the valves A, D, fig. 1, the rim is made with a screw, B, fig. 3, in order to receive a cap A A, fig. 3, full of small holes. This screw has also another use. If dephlogisticated air be preferred, a bladder filled with it, fig. 4, may, by means of the screw A, be fastened to the valve A, fig. 1; and, to prevent waste, as this air may serve several times, a flexible tube may be screwed on the valve D, fig. 1, communicating with the bladder by means of the opening d, fig. 4: thus it may be employed as often as the operator thinks proper.

There is a handle K to the partition in the middle, in order that, if it be at any time necessary to use either of the divisions alone, the other may be confined from acting. c, b, fig. 5, represent the two valves so be applied at the end of the instrument C, B, fig. 1; and fig. 6, is a section of the end C B, showing the valves in their proper places.

It is proper to add, that the capacity of the instrument should be proportioned to the quantity of air received into the lungs in inspiration, which Dr Goodwyn has ascertained to be twelve cubical inches or somewhat more. Each division of the instrument, therefore, should be capable of containing that quantity.

LUNG-WORT, in botany. See PULMONARIA.

LUNISOLAR YEAR, in chronology, the space of

532 common years; found by multiplying the cycle of the sun by that of the moon.

LUNULA. See LUNE.

LUPERCALIA, feasts instituted in ancient Rome, in honour of the god Pan.—The word comes from *Lupercal*, the name of a place under the Palatine mountain, where the sacrifices were performed.

The Lupercalia were celebrated on the 15th of the kalends of March, that is, on the 15th of February, or, as Ovid observes, on the third day after the ides. They are supposed to have been established by Evander.

On the morning of this feast, the Luperci, or priests of Pan, ran naked through the streets of Rome, striking the married women they met on the hands and belly with a thong or strap of goat's leather, which was held an omen promising them fecundity and happy deliveries. See LUPERICI.

This feast was abolished in the time of Augustus; but afterwards restored, and continued to the time of the emperor Anastasius.—Baronius says it was abolished by the pope in 496.

LUPERICI, a name given to the priests of the god Pan. See LUPERCALIA.

The *luperci* were the most ancient order of priests in Rome; they were divided into two colleges or companies, the one called *Fabii* and the other *Quintilii*. To these Cæsar added a third, which he called *Julii*.

LUPINUS, LUPINE, in botany: A genus of the decandria order, belonging to the diadelphia class of plants; and in the natural method ranking under the 32d order, *Papilionaceæ*. The calyx is bilabiate; there are five oblong and five roundish anthers; the legumen is coriaceous. There are seven species, six of them hardy herbaceous showery annuals, and one perennial, rising with upright stalks from one to three or four feet high, ornamented with digitate or fingered leaves, and terminated by long whorled spikes of papilionaceous flowers, white, blue, yellow, and rose-coloured. They are all easily raised from seed; and succeed in any open borders, where they make a fine variety.

The seeds of the white lupine, which have a leguminous taste accompanied with a disagreeable bitter one, are said to be anthelmintic, both internally taken, and applied externally. Caspar Hoffman cautions against their external use, and tells us (from one of the Arabian writers) that they have sometimes occasioned death. Simon Pauli also says, that he saw a boy of eight or ten years of age, after taking a dram of these seeds in powder, seized with exquisite pains in the abdomen, a difficulty of respiration, and almost total loss of voice; and that he was relieved from these complaints by a glyster of milk and sugar, which brought away a vast quantity of worms. But Mr Geoffroy observes, very justly, that either these symptoms were owing to the worms, and not to the medicine; or that these seeds, if they have any noxious quality, lose it with their bitterness in boiling; since they were commonly used among the Greeks as food, and recommended by Galen as very wholesome.

LUPULUS, in botany. See HUMULUS.

LUPUS, in zoology. See CANIS.

LUPUS-MARINUS. See ANARRHICHAS.

Lunula
Lupus.

LUPUS,

Lupus
|
Lusatia.

LUPUS, in astronomy. See there, n^o 406.

LURCHER, a kind of hunting-dog much like a mongrel grey-hound, with pricked ears, a shagged coat, and generally of a yellowish white colour: they are very swift runners, so that if they get between the burrows and the cones they seldom miss; and this is their common practice in hunting: yet they use other subtilties, as the tumbler does, some of them bringing in their game, and those are the best. It is also observable, that a lurcher will run down a hare at stretch.

LURE, in falconry, a device of leather, in the shape of two wings, stuck with feathers, and baited with a piece of flesh, to call back a hawk when at considerable distance.

LURGAN, a post and fair town in the county of Armagh and province of Ulster in Ireland, 67 miles from Dublin. It is a flourishing town, agreeably situated in the midst of a much improved country; and the inhabitants are extensively engaged in the linen manufacture. It stands on a gentle eminence, about two miles from Lough Neagh, of which it commands a most beautiful and extensive prospect. The fairs are three in the year. N. Lat. 54. 35. W. Long. 6. 31.

LURGAN-GREEN, a post and fair town of Ireland, in the county of Louth and province of Leinster, 37 miles from Dublin; a mile beyond which is a handsome seat of the earl of Charlemont. It has three fairs in the year.

LURIDÆ, the name of the 28th order in Linnaeus's fragments of a natural method. See BOTANY, p. 462.

LUSATIA, a marquisate of Germany, in Upper Saxony; bounded to the east by Silesia, to the west by Misnia, to the south by Bohemia, and to the north by the marquisate of Brandenburg. Till towards the middle of the 15th century, the Upper Lusatia was called the *Mark*, i. e. the marquisate or the land of *Budisain* and *Gorlitz*; and the Lower only *Lusatia*, which, it is said, in the Slavonic, signifies "a woody or marshy country." The air of the Upper Lusatia, which is hilly or mountainous, is better than that of the Lower, a great part of which is moorish and boggy. Both abound in wood, especially the Lower, and turf for fuel. The heathy and mountainous tracts are generally barren; but the lower champagne and marsh lands are tolerably fertile, producing palture, wheat, rye, oats, barley, buck-wheat, pease, lentils, beans, and millet; together with flax, hops, tobacco, some white and red wine, and what is called *manna*. Of several of these articles, however, considerable quantities are imported. In this country are found also quarries of stone, medicinal springs, bastard diamonds, agates, and jaspers, earthen and clays for tobacco-pipes and all sorts of earthen ware, alum, good iron, stone, vitriolic and copper water; nor is it destitute of cattle, fish, and venison. The rivers Spree, the Schwarze or Black Elster, and the Pulznitz, have their sources in the Lusatias, which are also watered by the Neisse and Queis. The ancient inhabitants of this country were the Saxons, who were succeeded by the Vandals, and these by the Sober-Wends, a Slavonian people. The present inhabitants, the descendants of the Wends, have an odd dress; and the language is so inarticulate and guttural, that it hath been

said, it might be pronounced without lips, teeth, or tongue: but the towns are almost wholly peopled by Germans.

In the Upper Lusatia are six towns which appear at the land-diets, 16 smaller country-towns, and four market towns. In the Lower are four diet-towns, 13 country-towns, and two market ones. Both marquisates were formerly subject either to the kings of Bohemia, the archdukes of Austria, or electors of Brandenburg; but, in 1636, both were absolutely ceded to the elector of Saxony, in lieu of the 72 tons of gold which he expended in assisting the emperor Ferdinand II. against the Bohemians.

Christianity was first planted in Lusatia in the seventh century; but it was several centuries after that before Popery was fully established. In the 11th century many cloisters were erected in the country; but at the reformation such numbers embraced Lutheranism, that it became the predominant religion, and still continues, though there are still several Roman Catholic foundations, churches, market-towns, and villages. The enthusiastic sect of HERNHUTERS possesses a great influence and esteem here. There are considerable manufactures of woollen and linen stuffs in the Lusatias, especially the Upper. At Budisfen, and in the adjacent country, prodigious quantities of stockings, spatterdashies, caps, and gloves are made. The linen manufactures also flourish here, chiefly in the Upper Lusatia, where all sorts of linen are made, printed, and dyed. Exclusive of these, there are considerable manufactures of hats, leather, paper, gunpowder, iron, glass, bleached wax, &c. Though the demand and exportation of these commodities, particularly linens and woollens, is not so great as formerly, yet it is still considerable, and more than overbalances their importations in wool, yarn, silk, wines, spices, corn, fresh and baked fruits, garden stuff, and hops. Disputes of many years standing have subsisted between the country-artificers and linen-manufacturers on the one side, and the diet-towns on the other; the latter unjustly seeking to exclude the former from any share in the linen trade. The natives of this country are said to have quick natural parts, but to be sordidly penurious. We are told they observe the Saxon laws much better than they did the Bohemian. Learning hath been much esteemed and encouraged in both marquisates since the reformation. The schools in the six diet-towns of Upper Lusatia, particularly at Gorlitz, Budisfen, and Zittau, greatly distinguish themselves, having handsome stipends. In Lower Lusatia also are some good schools, with stipends for the maintenance of students. Printing is said to be much followed, and brought to great perfection in this country.

In Upper Lusatia, the states consist, 1st, of those called *state-lords*; 2dly, of the prelates; 3dly, of the gentry and commonalty, under which are comprehended the counts, barons, nobles, and burgeses, possessors of fees and fief-estates; and, 4thly, of the representatives of the six principal towns. Without the consent of these states no taxes can be imposed, nor any thing of importance, that regards the public, transacted. The diets are ordinary or extraordinary. The ordinary meet once in three years, and the extraordinary when summoned by the sovereign upon particular emergencies. As to ecclesiastical matters, the dean of

Lusatia
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Lustral.

Budissen and his consistory exercise all manner of episcopal jurisdiction; and, among the Protestants, the jurisdiction belongs either to the superior, the upper-office, or the patrons. The revenues arising to the superior or sovereign, from Upper Lusatia, consist partly of the subsidies granted by the states, among which, at present, are reckoned capitation and estate-money; and partly of the beer-tax, excise, tolls, &c.—Upper Lusatia is divided into two great circles, viz. those of Budissen and Gorkitz, which are again divided into lesser circles.

The land-states of Lower Lusatia consist, like those of the Upper, of prelates, lords, and knights, and the representatives of the state towns, which are Luckau, Guben-Lubbin, and Kalau. Two land diets are yearly held at Lubben, called *voluntary-diets*; but when the superior causes the states to be summoned together at his discretion, and propositions to be laid before them, by commissaries deputed for that purpose, such convention is called a *great land-diet*. The marquisate is divided into five circles, each of which holds a circle-assembly in its circle-town. The chief officers appointed either by the superior or the states, are, the president of the upper-office, the land-captain, and the land-judge. The principal tribunals are, the land-court, and the upper-office, to which lie appeals from the inferior judicatories. There are also officers for the several circles. Spiritual matters belong here to a consistory, erected in 1668. The ordinary taxes are paid into the chest of the circle; and from thence assigned to the general chest, of which the upper tax-receiver is superintendent. By him an annual account of the receipts is made out, which is examined and passed by the deputies of the states.

LUSITANIA (anc. geog.), one of the divisions of Spain, extending to the north of the Tagus, quite to the sea of Cantabria, at least to the Promontorium Celticum. But Augustus, by a new regulation, made the Anas its boundary to the south, the Durus to the north; and thus constituting only a part of the modern Portugal. *Lusitani* the people, (Diodorus, Stephanus).

LUSTRAL, an epithet given by the ancients to the water used in their ceremonies to sprinkle and purify the people. From them the Romanists have borrowed the holy water used in their churches.

LUSTRAL Day, (*Dies Lustricus*), that whereon the lustrations were performed for a child, and its name given; which was usually the ninth day from the birth of a boy, and the eighth from that of a girl. Tho' others performed the ceremony on the last day of that week wherein the child was born, and others on the fifth day from its birth.

Over this feast-day the goddess Nundina was supposed to preside; the midwives, nurses, and domestics, handed the child backwards, and forwards, around a fire burning on the altars of the gods, after which they sprinkled it with water; hence this feast had the name of *amplidromia*. The old women mixed saliva and dust with the water. The whole ended with a sumptuous entertainment. The parents received gifts from their friends on this occasion. If the child was a male, their door was decked with an olive garland; if a female, with wool, denoting the work about which women were to be employed.

N^o 189.

LUSTRATION, in antiquity, sacrifices or cere-Lustration, monies by which the ancients purified their cities, fields, armies, or people, defiled by any crime or impurity. Some of these lustrations were public, others private. There were three species or manners of performing lustration, viz. by fire and sulphur, by water, and by air; which last was done by fanning and agitating the air round the thing to be purified. Some of these lustrations were necessary, i. e. could not be dispensed with; as lustrations of houses in time of a plague, or upon the death of any person: others again were done out of choice, and at pleasure. The public lustrations at Rome were celebrated every fifth year; in which they led a victim thrice round the place to be purified, and in the mean time burnt a great quantity of perfumes. Their country lustrations, which they called *ambarvalia*, were celebrated before they began to reap their corn: in those of the armies, which they called *armilustria*, some chosen soldiers, crowned with laurel, led the victims, which were a cow, a sheep, and a bull, thrice round the army ranged in battle-array in the field of Mars, to which deity the victims were afterwards sacrificed, after pouring out many imprecations upon the enemies of the Romans. The lustrations of their flocks were performed in this manner: the shepherd sprinkled them with pure water, and thrice surrounded his sheepfold with a composition of fawn, laurel, and brimstone set on fire; and afterwards sacrificed to the goddesses Pales an offering of milk boiled, wine, a cake, and millet. As for private houses, they were lustrated with water, a fumigation of laurel, juniper, olive-tree, fawn, and such like; and the victim commonly was a pig. Lustrations made for particular persons were commonly called *expiations*, and the victims *piacula*. There was also a kind of lustration used for infants, by which they were purified, girls the third, and boys the ninth, day after their birth; which ceremony was performed with pure water and spittle. See the article AMBARVALIA.—In their lustratory sacrifices, the Athenians sacrificed two men, one for the men of their city, and the other for the women. Divers of these expiations were austere; some fasted; others abstained from all sensual pleasures; and some, as the priests of Cybele, castrated themselves. The postures of the penitents were different according to the different sacrifices. The priests changed their habits according to the ceremony to be performed; white, purple, and black, were the most usual colours. They cast into the river, or at least out of the city, the animals or other things that had served for a lustration or sacrifice of atonement; and thought themselves threatened with some great misfortune when by chance they trod upon them. Part of these ceremonies were abolished by the emperor Constantine, and his successors: the rest subsisted till the Gothic kings were masters of Rome; under whom they expired, excepting what the popes thought proper to adopt and bring into the church.

For the lustration, or rather expiation, of the ancient Jews, see EXPIATION.

LUSTRE, the gloss or brightness appearing on any thing, particularly on manufactures of silk, wool, or stuff. It is likewise used to denote the composition or manner of giving that gloss.

The lustre of silks is given them by washing in soap, then

Lustre
Lutecia.

then clear water, and dipping them in alum water cold. To give stuffs a beautiful lustre : For every eight pounds of stuff allow a quarter of a pound of linseed ; boil it half an hour, and then strain it through a cloth, and let it stand till it is turned almost to a jelly : afterwards put an ounce and a half of gum to dissolve 24 hours ; then mix the liquor, and put the cloth into this mixture, take it out, dry it in the shade, and press it. If once doing is not sufficient, repeat the operation. Curriers give a lustre to black leather first with juice of barberries, then with gum-arabic, ale, vinegar, and Flanders-glue, boiled together. For coloured leather, they use the white of an egg beaten in water. Morroccos have their lustre from juice of barberries, and lemon or orange. For hats, the lustre is frequently given with common water ; sometimes a little black dye is added : the same lustre serves for furs, except that for every black fur they sometimes prepare a lustre of galls, coppers, Roman alum, ox's marrow, and other ingredients.

LUSTRE, an appellation given to a branched candle-stick, when made of glass. See BRANCH and JESSE.

LUSTRINGS. A company was incorporated for making, dressing, and lustrating alomades and lustrings in England, who were to have the sole benefit thereof, by stat. 4 and 5 William and Mary. And no foreign silks known by the name of *lustrings* or alomades are to be imported but at the port of London, &c. Stat. 9. and 10. W. III. c. 43. See SILK.

LUSTRUM, in Roman antiquity, a general muster and review of all the citizens and their goods, which was performed by the censors every fifth year, who afterwards made a solemn lustration. See the article LUSTRATION.

This custom was first instituted by Servius Tullius, about 180 years after the foundation of Rome. In course of time the lustra were not celebrated so often ; for we find the fifth lustrum celebrated at Rome only in the 574th year of that city.

LUTE, or LUTING, among chemists, a mixed, tenacious, ductile substance, which grows solid by drying, and, being applied to the juncture of vessels, stops them up so as to prevent the air from getting either in or out. See CHEMISTRY-Index.

LUTE, is also a musical instrument with strings.—The lute consists of four parts, *viz.* the table, the body or belly, which has nine or ten sides ; the neck, which has nine or ten stops or divisions, marked with strings ; and the head or cross, where the screw for raising and lowering the strings to a proper pitch of tone are fixed. In the middle of the table there is a rose or passage for the sound ; there is also a bridge that the strings are fastened to, and a piece of ivory between the head and the neck to which the other extremities of the strings are fitted. In playing, the strings are struck with the right hand, and with the left the stops are pressed. The lutes of Bologna are esteemed the best on account of the wood, which is said to have an uncommon disposition for producing a sweet sound.

LUTETIA PARISIORUM, (anc. geog.), a town of the Parisii, in Gallia Celtica, situated in an island in the Sequana or Seine. It received its name, as some suppose, from the quantity of clay, *lutum*, which is in its neighbourhood. J. Cæsar fortified and embellished it, from which circumstance some authors call it *Julii Civitas*. Vol. X. Part I.

vitas. Julian the apostate resided there for some time. It is now *Paris*, the capital of France ; so called from its name *Parisii* in the lower age.

LUTHER (Martin), the celebrated author of the Reformation, was a native of Eisleben in Saxony, and born in 1483. Though his parents were poor, he received a learned education ; during the progress of which, he gave many indications of uncommon vigour and acuteness of genius. As his mind was naturally susceptible of serious impressions, and tinged with somewhat of that religious melancholy which delights in the solitude and devotion of a monastic life, he retired into a convent of Augustinian friars ; where he acquired great reputation, not only for piety, but for love of knowledge and unwearied application to study. The cause of this retirement is said to have been, that he was once struck by lightning, and his companion killed by his side by the same flash. He had been taught the scholastic philosophy which was in vogue in those days, and made considerable progress in it ; but happening to find a copy of the bible which lay neglected in the library of his monastery, he applied himself to the study of it with such eagerness and assiduity, as quite astonished the monks ; and increased his reputation for sanctity so much, that he was chosen professor first of philosophy, and afterwards of theology, at Wittenberg on the Elbe, where Frederic elector of Saxony had founded an university.

While Luther continued to enjoy the highest reputation for sanctity and learning, Tetzel, a Dominican friar, came to Wittenberg in order to publish indulgences. Luther beheld his success with great concern ; and having first inveighed against indulgences from the pulpit, he afterwards published 95 theses, containing his sentiments on that subject. These he proposed, not as points fully established, but as subjects of inquiry and disputation. He appointed a day on which the learned were invited to impugn them either in person or by writing ; and to the whole he subjoined solemn protestations of his high respect for the apostolic see, and of his implicit submission to its authority. No opponent appeared at the time prefixed ; the theses spread over Germany with astonishing rapidity, and were read with the greatest eagerness.

Though Luther met with no opposition for some little time after he began to publish his new doctrines, it was not long before many zealous champions arose to defend those opinions with which the wealth and power of the clergy were so strictly connected. Their cause, however, was by no means promoted by these endeavours ; the people began to call in question even the authority of the canon law and of the pope himself.—The court of Rome at first despised these new doctrines and disputes ; but at last the attention of the pope being raised by the great success of the reformer, and the complaints of his adversaries, Luther was summoned, in the month of July 1518, to appear at Rome, within 60 days, before the auditor of the chamber. One of Luther's adversaries, named Prierias, who had written against him, was appointed to examine his doctrines, and to decide concerning them. The pope wrote at the same time to the elector of Saxony, beseeching him not to protect a man whose heretical and profane tenets were so shocking to pious ears ; and enjoined the provincial of the Augustinians

Luther.

gustinians to check by his authority the rashness of an arrogant monk, which brought disgrace upon their order, and gave offence and disturbance to the whole church.

From these letters, and the appointment of his open enemy Prierias to be his judge, Luther easily saw what sentence he might expect at Rome; and therefore discovered the utmost solicitude to have his cause tried in Germany, and before a less suspected tribunal. He wrote a submissive letter to the pope, in which he promised an unreserved obedience to his will, for as yet he entertained no doubt of the divine original of the pope's authority; and by the intercession of the other professors, Cajetan the pope's legate in Germany was appointed to hear and determine the cause. Luther appeared before him without hesitation: but Cajetan thought it below his dignity to dispute the point with a person so much his inferior in rank; and therefore required him, by virtue of the apostolic powers with which he was clothed, to retract the errors which he had uttered with regard to indulgences and the nature of faith, and to abstain for the future from the publication of new and dangerous opinions; and at the last forbade him to appear in his presence, unless he proposed to comply with what had been required of him.

This haughty and violent manner of proceeding, together with some other circumstances, gave Luther's friends such strong reasons to suspect that even the imperial safe-conduct would not be able to protect him from the legate's power and resentment, that they prevailed on him secretly to withdraw from Augsburg, where he had attended the legate, and to return to his own country. But before his departure, according to a form of which there had been some examples, he prepared a solemn appeal from the pope, ill-informed at that time concerning his cause, to the pope, when he should receive more full intimation with respect to it.—Cajetan, enraged at Luther's abrupt retreat, and at the publication of his appeal, wrote to the elector of Saxony, complaining of both; and requiring him, as he regarded the peace of the church, or the authority of its head, either to send that seditious monk a prisoner to Rome, or to banish him out of his territories. Frederic had hitherto, from political motives, protected Luther, as thinking he might be of use in checking the enormous power of the see of Rome; and though all Germany resounded with his fame, the elector had never yet admitted him into his presence. But upon this demand made by the cardinal, it became necessary to throw off somewhat of his former reserve. He had been at great expence and bestowed much attention on founding a new university, an object of considerable importance to every German prince; and foreseeing how fatal a blow the removal of Luther would be to its reputation, he not only declined complying with either of the pope's requests, but openly discovered great concern for Luther's safety.

The situation of our reformer, in the mean time, became daily more and more alarming. He knew very well what were the motives which induced the elector to afford him protection, and that he could by no means depend on a continuance of his friendship. If he should be obliged to quit Saxony, he had no

other asylum, and must stand exposed to whatever punishment the rage or bigotry of his enemies could inflict; and so ready were his adversaries to condemn him, that he had been declared a heretic at Rome before the expiration of the 60 days allowed him in the citation for making his appearance. Notwithstanding all this, however, he discovered no symptoms of timidity or remissness; but continued to vindicate his own conduct and opinions, and to inveigh against those of his adversaries with more vehemence than ever. Being convinced, therefore, that the pope would soon proceed to the most violent measures against him, he appealed to a general council, which he affirmed to be the representative of the Catholic church, and superior in power to the pope, who being a fallible man, might err, as St Peter, the most perfect of his predecessors, had done.

The court of Rome were equally assiduous in the mean time to crush the author of these new doctrines which gave them so much uneasiness. A bull was issued by the pope, of a date prior to Luther's appeal, in which he magnified the virtues of indulgences, and subjected to the heaviest ecclesiastical censures all who presumed to teach a contrary doctrine. Such a clear decision of the sovereign pontiff against him might have been very fatal to Luther's cause, had not the death of the emperor Maximilian, which happened on January 17. 1519, contributed to give matters a different turn. Both the principles and interest of Maximilian had prompted him to support the authority of the see of Rome: but, in consequence of his death, the vicariate of that part of Germany which is governed by the Saxon laws devolved to the elector of Saxony; and, under the shelter of his friendly administration, Luther himself enjoyed tranquillity, and his opinions took such root in different places, that they could never afterwards be eradicated. At the same time, as the election of an emperor was a point more interesting to the pope (Leo X.) than a theological controversy which he did not understand, and of which he could not foresee the consequences, he was so extremely solicitous not to irritate a prince of such considerable influence in the electoral college as Frederic, that he discovered a great unwillingness to pronounce the sentence of excommunication against Luther, which his adversaries continually demanded with the most clamorous importunity.

From the reason just now given, and Leo's natural aversion to severe measures, a suspension of proceeding against Luther took place for 18 months, though perpetual negotiations were carried on during this interval in order to bring the matter to an amicable issue. The manner in which these were conducted having given our reformer many opportunities of observing the corruption of the court of Rome, its obstinacy in adhering to established errors, and its indifference about truth, however clearly proposed or strongly proved, he began, in 1520, to utter some doubts with regard to the divine original of the papal authority, which he publicly disputed with Ecceus, one of his most learned and formidable antagonists. The dispute was indecisive, both parties claiming the victory; but it must have been very mortifying to the partizans of the Romish church to hear such an essential point of their doctrine publicly attacked.

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Luther.

The Papal authority being once suspected, Luther proceeded to push on his inquiries and attacks from one doctrine to another, till at last he began to shake the firmest foundations on which the wealth and power of the church were established. Leo then began to perceive that there were no hopes of reclaiming such an incorrigible heretic; and therefore prepared to denounce the sentence of excommunication against him. The college of cardinals was often assembled, in order to prepare the sentence with due deliberation; and the ablest canonists were consulted how it might be expressed with unexceptionable formality. At last it was issued on the 15th of June 1520. Forty-one propositions, extracted out of Luther's works, were therein condemned as heretical, scandalous, and offensive to pious ears; all persons were forbidden to read his writings, upon pain of excommunication; such as had any of them in their custody were commanded to commit them to the flames; he himself, if he did not, within 60 days, publicly recant his errors, and burn his books, was pronounced an obstinate heretic, excommunicated, and delivered to Satan for the destruction of the flesh; and all secular princes were required, under pain of incurring the same censure, to seize his person, that he might be punished as his crimes deserved.

Luther was not in the least disconcerted by this sentence, which he had for some time expected. He renewed his appeal to his general council; declared the pope to be that antichrist, or man of sin, whose appearance is foretold in the New Testament; declaimed against his tyranny with greater vehemence than ever; and at last, by way of retaliation, having assembled all the professors and students in the university of Wittemberg, with great pomp, and in the presence of a vast multitude of spectators, he cast the volumes of the canon law, together with the bull of excommunication, into the flames. The manner in which this action was justified, gave still more offence than the action itself. Having collected from the canon law some of the most extravagant propositions with regard to the plenitude and omnipotence of the pope's power, as well as the subordination of all secular jurisdiction to his authority, he published these with a commentary, pointing out the impety of such tenets, and their evident tendency to subvert all civil government.

On the accession of Charles V. to the empire, Luther found himself in a very dangerous situation. Charles, in order to secure the pope's friendship, had determined to treat him with great severity. His eagerness to gain this point, rendered him not averse to gratify the papal legates in Germany, who insisted, that, without any delay or formal deliberation, the diet then sitting at Worms ought to condemn a man whom the pope had already excommunicated as an incorrigible heretic. Such an abrupt manner of proceeding, however, being deemed unprecedented and unjust by the members of the diet, they made a point of Luther's appearing in person, and declaring whether he adhered or not to those opinions which had drawn upon him the censures of the church. Not only the emperor, but all the princes through whose territories he had to pass, granted him a safe conduct; and Charles wrote to him at the same time, requiring his immediate attendance on the diet, and renewing his promises of protection from any injury or violence. Luther did not

Luther.

hesitate one moment about yielding obedience; and set out for Worms, attended by the herald who had brought the emperor's letter and safe-conduct. While on his journey, many of his friends, whom the fate of Hufs, under similar circumstances, and notwithstanding the same security of an imperial safe-conduct, filled with solicitude, advised and intreated him not to rush wantonly into the midst of danger. But Luther, superior to such terrors, silenced them with this reply, "I am lawfully called (said he) to appear in that city; and thither will I go in the name of the Lord, though as many devils as there are tiles on the houses were there combined against me."

The reception which he met with at Worms, was such as might have been reckoned a full reward of all his labours, if vanity and the love of applause had been the principles by which he was influenced. Greater crowds assembled to behold him than had appeared at the emperor's public entry; his apartments were daily filled with princes and personages of the highest rank; and he was treated with an homage more sincere, as well as more flattering, than any which pre-eminence in birth or condition can command. At his appearance before the diet, he behaved with great decency, and with equal firmness. He readily acknowledged an excess of acrimony and vehemence in his controversial writings; but refused to retract his opinions unless he were convinced of their falsehood, or to consent to their being tried by any other rule than the word of God. When neither threats nor intreaties could prevail on him to depart from this resolution, some of the ecclesiastics proposed to imitate the example of the council of Constance, and, by punishing the author of this pestilent heresy, who was now in their power, to deliver the church at once from such an evil. But the members of the diet refusing to expose the German integrity to such reproach by a second violation of public faith, and Charles being no less unwilling to bring a stain upon the beginning of his administration by such an ignominious action, Luther was permitted to depart in safety. A few days after he left the city, a severe edict was published in the emperor's name, and by authority of the diet, depriving him, as an obstinate and excommunicated criminal, of all the privileges which he enjoyed as a subject of the empire, forbidding any prince to harbour or protect him, and requiring all to seize his person as soon as the term specified in his protection should be expired.

But this rigorous decree had no considerable effect; the execution of it being prevented partly by the multiplicity of occupations which the commotions in Spain, together with the wars in Italy and the Low Countries, created to the emperor; and partly by a prudent precaution employed by the elector of Saxony, Luther's faithful patron. As Luther, on his return from Worms, was passing near Altenstein in Thuringia, a number of horsemen in masks rushed suddenly out of a wood, where the elector had appointed them to lie in wait for him, and, surrounding his company, carried him, after dismissing all his attendants, to Wortburg, a strong castle not far distant. There the elector ordered him to be supplied with every thing necessary or agreeable; but the place of his retreat was carefully concealed, until the fury of the present storm against

Luther.

against him began to abate, upon a change in the political system of Europe. In this solitude, where he remained nine months, and which he frequently called his *Palmar*, after the name of that island to which the apostle John was banished, he exerted his usual vigour and industry in defence of his doctrines, or in confutation of his adversaries, publishing several treatises, which revived the spirit of his followers, astonished to a great degree and disheartened at the sudden disappearance of their leader.

Luther, weary at length of his retirement, appeared publicly again at Wittenberg, upon the 6th of March 1522. He appeared indeed without the elector's leave; but immediately wrote him a letter, to prevent his taking it ill. The edict of Charles V. as severe as it was, had given little or no check to Luther's doctrine: for the emperor was no sooner gone into Flanders, than his edict was neglected and despised, and the doctrine seemed to spread even faster than before. Carolostadius, in Luther's absence, had pushed things on faster than his leader; and had attempted to abolish the use of mass, to remove images out of the churches, to set aside auricular confession, invocation of saints, the abstaining from meats; had allowed the monks to leave their monasteries, to neglect their vows, and to marry; in short, had quite changed the doctrine and discipline of the church at Wittenberg: all which, though not against Luther's sentiments, was yet blamed by him, as being rashly and unseasonably done. Lutheranism was still confined to Germany: it was not got to France; and Henry VIII. of England made the most rigorous acts to hinder it from invading his realm. Nay, he did something more: to show his zeal for religion and the holy see, and perhaps his skill in theological learning, he wrote a treatise *Of the seven sacraments*, against Luther's book *Of the captivity of Babylon*; which he presented to Leo X. in October 1521. The pope received it very favourably; and was so well pleased with the king of England, that he complimented him with the title of *Defender of the faith*. Luther, however, paid no regard to his kingship; but answered him with great sharpness, treating both his person and performance in the most contemptuous manner. Henry complained of Luther's rude usage of him to the princes of Saxony; and Fisher, bishop of Rochester, replied to his answer, in behalf of Henry's treatise: but neither the King's complaint, nor the bishop's reply, was attended with any visible effects.

Luther, though he had put a stop to the violent proceedings of Carolostadius, now made open war with the pope and bishops; and, that he might make the people despise their authority as much as possible, he wrote one book against the pope's bull, and another against the order falsely called the *order of bishops*. The same year, 1522, he wrote a letter, dated July the 29th, to the assembly of the states of Bohemia; in which he assured them that he was labouring to establish their doctrine in Germany, and exhorted them not to return to the communion of the church of Rome; and he published also, this year, a translation of the New Testament in the German tongue, which was afterwards corrected by himself and Melancthon. This translation having been printed several times, and being in every body's hands, Ferdinand archduke of Au-

Luther.

stria, the emperor's brother, made a very severe edict, to hinder the farther publication of it; and forbade all the subjects of his imperial majesty to have any copies of it, or of Luther's other books. Some other princes followed his example; and Luther was so angry at it, that he wrote a treatise, *Of the secular powers*, in which he accuses them of tyranny and impiety. The diet of the empire was held at Nuremberg, at the end of the year; to which Hadrian VI. sent his brief, dated November the 25th: for Leo X. died upon the 2d of December 1521, and Hadrian had been elected pope upon the 9th of January following. In his brief, among other things, he observes to the diet, how he had heard, with grief, that Martin Luther, after the sentence of Leo X. which was ordered to be executed by the edict of Worms, continued to teach the same errors, and daily to publish books full of heresies: that it appeared strange to him, that so large and so religious a nation could be seduced by a wretched apostate friar; that nothing, however, could be more pernicious to Christendom: and that therefore he exhorts them to use their utmost endeavours to make Luther, and the authors of these tumults, return to their duty; or, if they refuse and continue obdurate, to proceed against them according to the laws of the empire, and the severity of the last edict.

The resolution of this diet was published in the form of an edict, upon the 6th of March 1523; but it had no effect in checking the Lutherans, who still went on in the same triumphant manner. This year Luther wrote a great many pieces: among the rest, one upon the dignity and office of the supreme magistrate; which Frederic elector of Saxony is said to have been highly pleased with. He sent, about the same time, a writing in the German language to the Waldenses, or Pickards, in Bohemia and Moravia, who had applied to him "about worshipping the body of Christ in the eucharist." He wrote also another book, which he dedicated to the senate and people of Prague, "about the institution of ministers of the church." He drew up a form of saying mass. He wrote a piece, entitled, *An example of popish doctrine and divinity*; which Dupins calls a *satire against nuns and those who profess a monastic life*. He wrote also against the vows of virginity, in his preface to his commentary on 1 Cor. viii. And his exhortations here were, it seems, followed with effects: for soon after, nine nuns, among whom was Catharine de Bore, eloped from the nunnery at Nimptschen, and were brought, by the assistance of Leonard Copen, a burgess of Torgau, to Wittenberg. Whatever offence this proceeding might give to the Papists, it was highly extolled by Luther; who, in a book written in the German language, compares the deliverance of these nuns from the slavery of a monastic life, to that of the souls which Jesus Christ has delivered by his death. This year Luther had occasion to canonize two of his followers, who, as Melchior Adam relates, were burnt at Brussels in the beginning of July, and were the first who suffered martyrdom for his doctrine. He wrote also a consolatory epistle to three noble ladies at Misnia, who were banished from the duke of Saxony's court at Friburg, for reading his books.

In the beginning of the year 1524, Clement VII. sent

Luther. sent a legate into Germany to the diet, which was to be held at Nuremberg. Hadrian VI died in October 1523, and was succeeded by Clement upon the 19th of November. A little before his death he canonized Benno, who was bishop of Meissen in the time of Gregory VII. and one of the most zealous defenders of the holy see. Luther, imagining that this was done directly to oppose him, drew up a piece with this title, *Against the New Idol and Old Devil set up at Meissen*; in which he treats the memory of Gregory with great freedom, and does not spare even Hadrian. Clement VII.'s legate represented to the diet of Nuremberg the necessity of enforcing, the execution of the edict of Worms, which had been strangely neglected by the princes of the empire: but, notwithstanding the legate's solicitations, which were very pressing, the decrees of that diet were thought so ineffectual, that they were condemned at Rome, and rejected by the emperor. It was in this year that the dispute between Luther and Erasmus, about free-will, began. Erasmus had been much courted by the Papists to write against Luther; but he was all along of opinion, that writing would not be found an effectual way to end the differences and establish the peace of the church. However, tired out at length with the importunities of the pope and the Catholic princes, and desirous at the same time to clear himself from the suspicion of favouring a cause which he would not seem to favour, he resolved to write against Luther, though, as he tells Melancthon, it was with some reluctance, and chose free-will for the subject. His book was intitled, *A Diatribe, or Conference about Free-will*; and was written with much moderation, and without personal reflections. He tells Luther in the preface, "That he ought not to take his dissenting from him in opinion ill, because he had allowed himself the liberty of differing from the judgment of popes, councils, universities, and doctors of the church." Luther was some time before he answered Erasmus's book; but at last published a treatise *De Servo Arbitrio, or Of the Servitude of Man's Will*; and though Melancthon had promised Erasmus, that Luther should answer him with civility and moderation, yet Luther had so little regard to Melancthon's promise, that he never wrote any thing sharper. He accused Erasmus of being careless about religion, and little solicitous what became of it, provided the world continued in peace; and that his notions were rather philosophical than Christian. Erasmus immediately replied to Luther, in a piece called *Hyperapophyses*; in the first part of which he answers his arguments, and in the second his personal reflections.

In October 1524, Luther flung off the monastic habit; which, though not premeditated and designed, was yet a very proper preparative to a step he took the year after; we mean, his marriage with Catharine de Bore. Catharine de Bore was a gentleman's daughter, who had been a nun, and was taken, as we have observed, out of the nunnery of Nimptchen, in the year 1523. Luther had a design, as Melchior Adam relates, to marry her to Glacius, a minister of Orlamunden: but he did not like Glacius; and so Luther married her himself upon the 13th of June 1525. This conduct of his was blamed not only by the Catholics, but, as Melancthon says, by those of his own party. He was even for some time ashamed of it him-

self; and owns, that his marriage had made him so despicable, that he hoped his humiliation would rejoice the angels, and vex the devils. Melancthon found him so afflicted with what he had done, that he wrote some letters of consolation to him. It was not so much the marriage, as the circumstances of the time, and the precipitation with which it was done, that occasioned the censures passed upon Luther. He married all of a sudden, and at a time when Germany was groaning under the miseries of a war which was laid at least to be owing to Lutheranism. Then, again, it was thought an indecent thing in a man of 42 years of age, who was then, as he pretended, restoring the Gospel, and reforming mankind, to involve himself in marriage with a woman of 26, either through incontinence, or any account whatever. But Luther, as soon as he had recovered himself a little from this abasement, assumed his former air of intrepidity, and boldly supported what he had done with reasons. "I took a wife (says he), in obedience to my father's commands; and hastened the consummation, in order to prevent impediments, and stop the tongues of slanderers." It appears from his own confession, that this reformer was very fond of Mrs de Bore, and used to call her *his Catharine*; which made profane people think and say wicked things of him: "And therefore (says he) I married of a sudden, not only that I might not be obliged to hear the clamours which I knew would be raised against me, but to stop the mouths of those who reproached me with Catharine de Bore." Luther also gives us to understand, that he did it partly as concurring with his grand scheme of opposing the Catholics.

Luther, notwithstanding, was not himself altogether satisfied with these reasons. He did not think the step he had taken could be sufficiently justified upon the principles of human prudence; and therefore we find him, in other places, endeavouring to account for it from a supernatural impulse. But whether there was any thing divine in it or not, Luther found himself extremely happy in his new state, and especially after his wife had brought him a son. "My rib Kate (says he in the joy of his heart) desires her compliments to you, and thanks you for the favour of your kind letter. She is very well, through God's mercy. She is obedient and complying with me in all things; and more agreeable, I thank God, than I could have expected; so that I would not change my poverty for the wealth of Cæsar." He was heard to say (Szekendorf tells us), that he would not exchange his wife for the kingdom of France, nor for the riches of the Venetians; and that for three reasons: first, Because she had been given him by God, at the time when he implored the assistance of the Holy Ghost in finding a good wife; secondly, Because, though she was not without faults, yet she had fewer than other women; and, thirdly, Because the religiously observed the conjugal fidelity she owed him. There went at first a report, that Catharine de Bore was brought to bed soon after her marriage with Luther; but Erasmus, who had wrote that news to his friends, acknowledged the falsity of it a little after.

His marriage, however, did not retard his activity and diligence in the work of reformation. He revived the Augsburg confession of faith, and apology for the

Luther.

Luther.

Protestants, when the Protestant religion was first established on a firm basis. See PROTESTANTS and REFORMATION.

After this, Luther had little else to do than to sit down and contemplate the mighty work he had finished: for that a single monk should be able to give the church so rude a shock, that there needed but such another entirely to overthrow it, may very well seem a mighty work. He did indeed little else: for the remainder of his life was spent in exhorting princes, states, and universities, to confirm the reformation which had been brought about through him; and publishing from time to time such writings as might encourage, direct, and aid, them in doing it. The emperor threatened temporal punishment with armies, and the pope eternal with bulls and anathemas; but Luther cared for none of their threats. His friend and coadjutor Melancthon was not so indifferent; for Melancthon had a great deal of softness, moderation, and diffidence in his make, which made him very uneasy, and even sorrowful, in the present disorders. Hence we find many of Luther's letters written on purpose to support and comfort him under these several distresses and anxieties.

In the year 1533, Luther wrote a consolatory epistle to the citizens of Osiatatz, who had suffered some hardships for adhering to the Augsberg confession of faith; in which, among other things, he says: "The devil is the host, and the world is his inn; so that wherever you come, you shall be sure to find this ugly host." He had also about this time a terrible controversy with George duke of Saxony, who had such an aversion to Luther's doctrine, that he obliged his subjects to take an oath that they would never embrace it. However, 60 or 70 citizens of Leipzig were found to have deviated a little from the Catholic way in some point or other, and they were known previously to have consulted Luther about it; upon which George complained to the elector John, that Luther had not only abused his person, but also preached up rebellion among his subjects. The elector ordered Luther to be acquainted with this; and to be told at the same time, that if he did not clear himself of the charge, he could not possibly escape punishment. But Luther easily refuted the accusation, by proving, that he had been so far from stirring up his subjects against him, on the score of religion, that, on the contrary, he had exhorted them rather to undergo the greatest hardships, and even suffer themselves to be banished.

In the year 1534, the Bible translated by him into German was first printed, as the old privilege, dated at Bibliopolis, under the elector's hand, shews; and it was published the year after. He also published this year a book against masses and the consecration of priests, in which he relates a conference he had with the devil upon those points; for it is remarkable in Luther's whole history, that he never had any conflicts of any kind within, but the devil was always his antagonist. In February 1537, an assembly was held at Smalkald about matters of religion, to which Luther and Melancthon were called. At this meeting Luther was seized with so grievous an illness, that there were no hopes of his recovery. He was afflicted with the stone, and had a stoppage of urine for 11 days. In this terrible condition he would needs undertake to tra-

Luther.

vel, notwithstanding all that his friends could say or do to prevent him: his resolution, however, was attended with a good effect; for the night after his departure he began to be better. As he was carried along, he made his will, in which he bequeathed his detestation of Popery to his friends and brethren; agreeably to what he often used to say: *Pellis eram vivens, nortiens ero mors tua, papa*; that is, "I was the plague of Popery in my life, and shall continue to be so in my death."

This year the Pope and the court of Rome, finding it impossible to deal with the Protestants by force, began to have recourse to stratagem. They affected therefore to think, that though Luther had indeed carried things on with a high hand and to a violent extreme, yet what he had pleaded in defence of these measures was not entirely without foundation. They talked with a seeming show of moderation; and Pius III. who succeeded Clement VII. proposed a reformation first among themselves, and even went so far as to fix a place for a council to meet at for that purpose. But Luther treated this farce as it deserved to be treated; unmasked and detected it immediately; and, to ridicule it the more strongly, caused a picture to be drawn, in which was represented the pope seated on high upon a throne, some cardinals about him with foxes tails on, and seeming to evacuate upwards and downwards (*sursum deorsum repurgare*, as Melchior Adam expresses it). This was fixed over-against the title-page, to let the readers see at once the scope and design of the book; which was, to expose that cunning and artifice with which those subtle politicians affected to cleanse and purify themselves from their errors and superstitious. Luther published about the same time A Confutation of the pretended Grant of Constantine to Sylvester Bishop of Rome; and also some letters of John Huls, written from his prison at Constance to the Bohemians.

In this manner was Luther employed till his death, which happened in the year 1546. That year, accompanied by Melancthon, he paid a visit to his own country, which he had not seen for many years, and returned again in safety. But soon after he was called thither again by the earls of Mansfeldt, to compose some differences which had arisen about their boundaries. Luther had not been used to such matters; but because he was born at Illeben, a town in the territory of Mansfeldt, he was willing to do his country what service he could, even in this way. Preaching his last sermon therefore at Wittemberg, upon the 17th of January, he set off on the 23d; and at Hall in Saxony lodged with Julius Jonas, with whom he staid three days, because the waters were out. Upon the 28th, he passed over the river with his three sons and Dr Jonas; and being in some danger, he said to the Doctor, "Do not you think it would rejoice the devil exceedingly, if I and you, and my three sons, should be drowned?" When he entered the territories of the earls of Mansfeldt, he was received by 100 horsemen or more, and conducted in a very honourable manner; but was at the same time so very ill, that it was feared he would die. He said, that these fits of sickness often came upon him when he had any great business to undertake: of this, however, he did not recover; but died upon the 18th of February, in the

Luther,
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the 63d year of his age. A little before he expired, he admonished those that were about him to pray to God for the propagation of the Gospel; "because (said he) the council of Trent, which had fat once or twice, and the pope, would devise strange things against it." Soon after, his body was put into a leaden coffin, and carried with funeral pomp to the church at Ilseben, when Dr Jonas preached a sermon upon the occasion. The ears of Mansfeldt desired that his body should be interred in their territories; but the elector of Saxony insisted upon his being brought back to Wittenberg; which was accordingly done: and there he was buried with the greatest pomp that perhaps ever happened to any private man. Princes, earls, nobles, and students without number, attended the puceffion; and Melancthon made his funeral oration.

A thousand lies were invented by the Papists about Luther's death. Some said that he died suddenly; others, that he killed himself; others, that the devil strangled him; others, that his corpse stunk so abominably, that they were forced to leave it in the way, as it was carried to be interred. Nay, lies were invented about his death, even while he was yet alive. Luther, however, to give the most effectual refutation of this account of his death, put forth an advertisement of his being alive; and, to be even with the Papists for the malice they had shown in this lie, wrote a book at the same time to prove, that "the papacy was founded by the devil."

Luther's works were collected after his death, and printed at Wittenberg in 7 vols folio. Catharine de Bore furvived her husband a few years; and continued the first year of her widowhood at Wittenberg, though Luther had advised her to seek another place of residence. She went from thence in the year 1547, when the town was surrendered to the emperor Charles V. Before her departure, she had received a present of 50 crowns from Christian III. king of Denmark; and the elector of Saxony, and the counts of Mansfeldt, gave her good tokens of their liberality. With these additions, to what Luther had left her, she had wherewithal to maintain herself and her family handsomely. She returned to Wittenberg, when the town was restored to the elector; where she lived in a very devout and pious manner, till the plague obliged her to leave it again in the year 1552. She sold what she had at Wittenberg; and retired to Torgau, with a resolution to end her life there. An unfortunate mischance befel her in her journey thither, which proved fatal to her. The horses growing unruly, and attempting to run away, she leaped out of the vehicle she was conveyed in; and, by leaping, got a fall, of which she died about a quarter of a year after, at Torgau, upon the 20th of December 1552. She was buried there in the great church, where her tomb and epitaph are still to be seen; and the university of Wittenberg, which was then at Torgau because the plague raged at Wittenberg, made a public programma concerning the funeral pomp.

LUTHERANISM, the sentiments of Martin Luther with regard to religion. See **LUTHER**.

Lutheranism has undergone some alterations since the time of its founder.—Luther rejected the epistle of St James, as inconsistent with the doctrine of St Paul,

in relation to justification; he also set aside the Apocalypse: both which are now received as canonical in the Lutheran church.

Luther reduced the number of sacraments to two, viz. baptism, and the eucharist: but he believed the impanation, or consubstantiation, that is, that the matter of the bread and wine remain with the body and blood of Christ; and it is in this article that the main difference between the Lutheran and English churches consists.

Luther maintained the mass to be no sacrifice; exploded the adoration of the host, auricular confession, meritorious works, indulgences, purgatory, the worship of images, &c. which had been introduced in the corrupt times of the Romish church. He also opposed the doctrine of free-will, maintained predestination, and asserted our justification to be solely by the imputation of the merits and satisfaction of Christ. He also opposed the fastings in the Romish church, monachal vows, the celibate of the clergy, &c.

LUTHERANS, the Christians who follow the opinions of Martin Luther, one of the principal reformers of the church in the 16th century. See **LUTHER**.

The Lutherans, of all Protestants, are those who differ least from the Romish church; as they affirm, that the body and blood of Christ are materially present in the sacrament of the Lord's supper, though in an incomprehensible manner; and likewise represent some religious rites and institutions, as the use of images in churches, the distinguishing vestments of the clergy, the private confession of sins, the use of wafers in the administration of the Lord's supper, the form of exorcism in the celebration of baptism, and other ceremonies of the like nature, as tolerable, and some of them as useful. The Lutherans maintain, with regard to the divine decrees, that they respect the salvation or misery of men, in consequence of a previous knowledge of their sentiments and characters, and not as free and unconditional, and as founded on the mere will of God. Towards the close of the last century, the Lutherans began to entertain a greater liberality of sentiment than they had before adopted; though in many places they persevered longer in severe and despotic principles than other Protestant churches. Their public teachers now enjoy an unbounded liberty of dissenting from the decisions of those symbols or creeds which were once deemed almost infallible rules of faith and practice, and of declaring their dissent in the manner they judge the most expedient. Mosheim attributes this change in their sentiments to the maxim which they generally adopted, that Christians were accountable to God alone for their religious opinions; and that no individual could be justly punished by the magistrate for his erroneous opinions, while he conducted himself like a virtuous and obedient subject, and made no attempts to disturb the peace and order of civil society.

LUTHERN, in architecture, a kind of window over the cornice, in the roof of a building; standing perpendicularly over the naked of a wall, and serving to illuminate the upper story.

Lutherns are of various forms; as square, semicircular, round, called *bull's eyes*, *flat arches*, &c.

LUTRA, in zoology. See **MUSTELA**.

LUTTI (Beneditto), an eminent painter, born at Florence.

Lutherans
Luttr.

Florence in 1666. He was the disciple of Antonio Dominico Gabiani, and his merit was judged equal to that of his master: he painted few beside easel pieces; and his works were much valued and fought for in England, France, and Germany. The emperor knighted him; and the elector of Mentz, together with his patent of knighthood, sent him a cross set with diamonds. Lutti was never satisfied in finishing his pictures; yet though he often retouched them, they never appeared laboured. He died in 1724.

LUTZEN, a town of Upper Saxony in Germany; famous for a battle fought here in 1632, when Gustavus Adolphus king of Sweden was killed. It is situated upon the river Elster, in E. Long. 12. 37. N. Lat. 51. 20.

LUXATION, is when any bone is moved out of its place or articulation, so as to impede or destroy its proper office or motion. See SURGERY.

LUXEMBURG, a city of the Austrian Netherlands, and capital of a duchy of the same name. It is seated partly on a hill, and partly on a plain; but is very strong both by art and nature. It is but indifferently built, though there are some good stone houses in it. There is nothing very remarkable among the structures but the Jesuits church; which is a handsome edifice, after the modern taste. It was taken by Louis XIV. in 1684; who so augmented the fortifications, that it is now one of the strongest towns in Europe. It was ceded to Spain by the treaty of Ryswick; but the French took it again in 1701, and gave it up to the house of Austria by the treaty of Utrecht. It is 25 miles south-west of Treves, and 100 west of Mentz. E. Long. 6. 10. N. Lat. 49. 52.

LUXEMBURG (the duchy of), is one of the 17 provinces of the Netherlands. It is bounded on the east by the archbishopric of Treves; on the south, by Lorrain; on the west, partly by Champagne, and partly by the bishopric of Liege, which likewise, with part of Limburg, bound it on the north. It lies in the forest of Ardenne, which is one of the most famous in Europe. In some places it is covered with mountains and woods, and in general it is fertile in corn and wine; and here are a great number of iron-mines. The principal rivers are, the Moselle, the Sour, the Ourte, and the Semoy. It belongs partly to the house of Austria, and partly to the French; and Thionville is the capital of the French part.

LUXEMBURG (François Henry de Montmorency), duke of, and marshal of France, a renowned general in the service of Louis XIV. was born in 1628. He was with the prince of Condé at the battle of Rocroy, in 1643; and in 1668 distinguished himself at the conquest of Franche Comté. In 1672, he commanded in chief the French army in Holland; when he defeated the enemy near Woerden and Bodegrave, and was universally admired for the fine retreat he made in 1673. He became marshal of France in 1675; gained the battle of Fleurus in 1690, that of Steenkirk in 1692, and that of Nerwind in 1693. He died at Versailles in 1695.

LUXURIANS FLOS, "a luxuriant or double flower?" a flower, some of whose parts are increased in number, to the diminution or entire exclusion of others.

The parts that are augmented or multiplied in luxuriant flowers, are the flower-cup and petals, which Linnæus considers as the teguments or covers of the flower; the parts that are diminished, or entirely excluded, are the stamina or chives, which the same author denominates the male organs of generation.

Luxuriance in flowers is capable of the three following varieties.

1. A flower is said to be MULTIPLIED (*flos multiplicatus*), when the increase of the petals is not such as to exclude all the stamina: in this sense, flowers are properly said to be double, triple, or quadruple, according to the number of multiplications of the petals.

2. A flower is said to be FULL, (*flos plenus*), when, by the multiplication of the petals, all the stamina are excluded. Such are most of the double flowers that engage the attention of florists.

3. A flower is said to be PROLIFIC (*flos proliifer*), which produces flowers, and sometimes leaves, from its centre.

For a particular description of each of these kinds of luxuriance in flowers, see the articles MULTIPLICATUS FLOS, PLENUS FLOS, and PROLIFER FLOS.

Many natural orders of plants do not in any circumstances produce luxuriant flowers. Of this kind are the malqued-flowers of Tournefort, excepting calve's-hiout; the rough-leaved, umbelliferous, starry plants, and such as flower at the joints, of Ray: some umbelliferous flowers, however, are *prolific*.

The pea-bloom, or butterfly-shaped flowers, are rarely rendered double; some instances, however, of luxuriance, are observed in a species of ladies-finger, cornilla, and broom.

All luxuriant flowers are vegetable monsters. Such as are perfectly full, by which we mean the greatest degree of luxuriance, cannot be propagated by seeds; because these, for want of impregnation, can never ripen. Full flowers therefore are very properly denominated by Linnæus *evnuchs*. This highest degree of luxuriance is very common in carnation, lychnis, anemone, stock, Indian roses, cress, marsh marigold, ranunculus, violet, pæony, and narcissus.

Flowers which do not exclude all the stamina, perfect their seeds. Of this kind are poppy, fennel-flower, campanula, and some others.

Some flowers, as those of the water-lily, fig-marigold, and cactus, have many rows or series of petals, without the number of stamina being in the least diminished. Such flowers are by no means to be reckoned luxuriant, in the slightest degree.

Luxuriance in flowers is generally owing to excess of nourishment.

LUXURY; voluptuousness, or an extravagant indulgence in diet, dress, and equipage.

Luxury, among the Romans, prevailed to such a degree, that several laws were made to suppress, or at least limit it. The extravagance of the table began about the time of the battle of Actium, and continued in great excess till the reign of Calba. Peacocks, cranes of Malta, nightingales, venison, wild and tame fowl, were considered as delicacies. A profusion of provisions was the reigning taste. Whole wild boars were often served up, and sometimes they were filled with various small animals, and birds of different kinds: this dish they called the *Trojan horse*, in allusion to the wooden horse filled with soldiers.

Fowls

Fowls and game of all sorts were served up in whole pyramids, piled up in dishes as broad as moderate tables. Lucullus had a particular name for each apartment; and in whatever room he ordered his servants to prepare the entertainment, they knew by the direction the expence to which they were to go. When he supped in the Apollo, the expence was fixed at 50,000 *drachmae*, that is L. 1250. M. Antony provided eight boars for 12 guests. Vitellius had a large silver platter, said to have cost a million of *sesterties*, called *Minerva's buckler*. In this he blended together the livers of gilt-heads, the brains of pheasants and peacocks, the tongues of pleniocopters, and the milts of lampreys. Caligula served up to his guests pearls of great value dissolved in vinegar; the same was done also by Clodius the son of *Æsop* the tragedian. Apicius laid aside 90,000,000 of *sesterties*, besides a mighty revenue, for no other purpose but to be sacrificed to luxury: finding himself involved in debt, he looked over his accounts, and though he had the sum of 10,000,000 of *sesterties* still left, he poisoned himself for fear of being starved to death.

The Roman laws to restrain luxury were *Lex Orchia*, *Fannia*, *Didia*, *Licinia*, *Cornelia*, and many others: But all these were too little; for as riches increased amongst them, so did sensuality.

What were the ideas of luxury entertained in England about two centuries ago, may be gathered from the following passage of Holinshed; who, in a discourse prefixed to his History, speaking of the increase of luxury, says, "Neither do I speak this in reproach of any man, God is my judge; but to shew, that I do rejoice rather to see how God has blessed us with his good gifts, and to behold how that in a time wherein all things are grown to the most excessive prices, we yet do find means to obtain and achieve such furniture as heretofore was impossible. There are old men yet dwelling in the village where I remain, which have noted three things to be marvelously altered in England within their sound remembrance. One is the multitude of chimneys lately erected; whereas in their young days there were not above two or three, if so many, in most uplandish towns of the realm (the religious houses, and manor places of their lords, always excepted, and peradventure some great performances), but each made his fire against a reredoss [screen] in the hall where he dressed his meat and dined.—The second is the great amendment of lodging; for, said they, our fathers and we ourselves have lain full oft upon straw pallets covered only with a sheet, under coverlets made of a dogswine or horharrlots (to use their own terms), and a good log under their head instead of a bolster.—If it were so that the father or good man of the house had a mattress, or flock bed and sheets, a sack of chaff to rest his head upon, he thought himself to be as well lodged as the lord of the town. So well were they contented, that pillows (said they) were thought meet only for women in childbed; as for servants, if they had any sheet above them, it was well; for seldom had they any under their bodies to keep them from pricking straws, that ran off through the canvas and their hardened hides.—The third thing they tell of, is the exchange of treene [wooden] platters unto pewter, and wooden spoons into silver or tin; for

so common were all sorts of treene vessels in old times, that a man should hardly find four pieces pewter (of which one was peradventure a saft) in a good farmer's house. Again, in times past, men were contented to dwell in houses builded of fallow, willow, &c. so that the use of oak was in a manner dedicated wholly unto churches, religious houses, princes palaces, navigation, &c. But now willow, &c. are rejected, and nothing but oak any where regarded; and yet see the change, for when our houses were builded of willow, then had we oaken men; but now that our houses are come to be made of oak, our men are not only become willow, but a great many altogether of straw, which is a fore alteration. In these, the courage of the owner was a sufficient defence to keep the house in safety; but now the assurance of the timber must defend the men from robbing. Now have we many chimneys, and yet our tenderlins complain of rheums, catarrhs, and pokes; then had we none but reredosses, and our heads did never ach. For as the smoke in those days were supposed to be a sufficient hardening for the timber of the house; so it was reputed a far better medicine to keep the Goodman and his family from the quacks or pokes; wherewith, as then, very few were acquainted. Again, our pewterers in time past employed the use of pewter only upon dishes and pots, and a few other trifles for service; whereas now they are grown into such exquisite cunning, that they can in a manner imitate by infusion any form or fashion, of cup, dish, salt, bowl, or goblet, which is made by the goldsmiths craft, though they be ever so curious and very artificially forged. In some places beyond the sea, a garnish of good flat English pewter (I say flat, because dishes and platters in my time began to be made deep, and like basons, and are indeed more convenient both for sauce and keeping the meat warm) is esteemed so precious as the like number of vessels that are made of fine silver."

Particular instances of luxury in eating, however, might be adduced from an earlier period, surpassing even the extravagance of the Romans. Thus, in the 10th year of the reign of Edward IV. 1470, George Nevill, brother to the earl of Warwick, at his instalment into the archiepiscopal see of York, entertained most of the nobility and principal clergy, when his bill of fare was 300 quarters of wheat, 350 tons of ale, 104 tons of wine, a pipe of spiced wine, 80 fat oxen, six wild bulls, 1004 wethers, 300 hogs, 300 calves, 3000 geese, 3000 capons, 300 pigs, 100 peacocks, 200 cranes, 200 kids, 2000 chickens, 4000 pigeons, 4000 rabbits, 204 bitterns, 4000 ducks, 200 pheasants, 500 partridges, 2000 woodcocks, 400 plovers, 100 curlews, 100 quails, 1000 egrets, 200 rees, 400 bucks, does, and roebucks, 1506 hot venison patties, 4000 cold ditto, 1000 dishes of jelly parted, 4000 dishes of jelly plain, 4000 cold custards, 2000 hot custards, 300 pikes, 300 breams, eight seals, four porpuisses, 400 tarts. At this feast the earl of Warwick was steward, the earl of Bedford treasurer, and lord Hastings comptroller, with many more noble officers; 1000 servants, 62 cooks, 515 menial apparitors in the kitchen.—But such was the fortune of the man, that after his extreme prodigality he died in the most abject but unpitied poverty, *vinētus jacuit in summa inopia*.

And as to *dress*, luxury in that article seems to have

Luxury. attained a great height long before Holinshed's time: For in the reign of Edward III. we find no fewer than seven sumptuary laws passed in one session of parliament to restrain it. It was enacted, that men servants of lords, as also of tradesmen and artificers, shall be content with one meal of fish or flesh every day; and the other meals, daily, shall be of milk, cheese, butter, and the like. Neither shall they use any ornaments of gold, silk, or embroidery; nor their wives and daughters any veils above the price of twelvecence. Artisans and yeomen shall not wear cloth above 40s. the whole piece (the finest then being about L.6 per piece), nor the ornaments before named. Nor the women any veils of silk, but only those of thread made in England. Gentlemen under the degree of knights, not having L.100 yearly in land, shall not wear any cloth above 4½ marks the whole piece. Neither shall they or their females use cloth of gold, silver, or embroidery, &c. But esquires having L.200 *per annum* or upwards of rent, may wear cloths of five marks the whole piece or cloth; and they and their females may also wear stuff of silk, silver, ribbons, girdles, or furs. Merchants, citizens, burghers, and artificers of tradesmen, as well of London as elsewhere, who have goods and chattels of the clear value of L.500, and their females, may wear as is allowed to gentlemen and esquires of L.100 *per annum*. And merchants, citizens, and burgesses, worth above L.1000 in goods and chattels, may (and their females) wear the same as gentlemen of L.200 *per annum*. Knights of 200 marks yearly may wear cloth of six marks the cloth, but no higher; but no cloth of gold, nor furred with ermine: but all knights and ladies having above 400 marks yearly, up to L.1000 *per annum*, may wear as they please, ermine excepted; and they may wear ornaments of pearl and precious stones for their heads only. Clerks having degrees in cathedrals, colleges, &c. may wear as knights and esquires of the same income. Plowmen, carters, shepherds, and such like, not having 40s. value in goods or chattels, shall wear no fort of cloth but blanket and russet lawn of 12d. and shall wear girdles and belts; and they shall only eat and drink suitable to their stations. And whosoever uses other apparel than is prescribed by the above laws shall forfeit the same.

Concerning the general utility of luxury to a state, there is much controversy among the political writers. Baron Montequieu lays it down, that luxury is necessary in monarchies, as in France; but ruinous to democracies, as in Holland. With regard therefore to Britain, whose government is compounded of both species, it is held to be a dubious question, how far private luxury is a public evil; and, as such, cognisable by public laws. And indeed our legislators have several times changed their sentiments as to this point; for formerly there were a number of penal laws existing to restrain excess in apparel, chiefly made in the reigns of Edward III. IV. and Henry VIII. a specimen of which we have inserted above. But all of them it appeared expedient to repeal at an after period. In fact, although luxury will of necessity increase according to the influx of wealth, it may not be for the general benefit of commerce to impose, as in the above cited laws, an absolute prohibition of every degree of it: yet, for the good of the public,

it may be necessary that such as go beyond proper bounds in eating, drinking, and wearing what by no means is suitable to their station, should be taxed accordingly, could it be done without including those who have a better title to such indulgence. This is certainly, however, a point which should be maturely weighed before executed; and, in mercantile countries at least, such restraints may be found prejudicial, most likely impracticable, especially where true liberty is established. Sir William Temple observes, speaking of the trade and riches, and at the same time of the *frugality* of the Hollanders, "That some of our maxims are not so certain as current in politics: as that encouragement of excess and luxury, if employed in the consumption of *native* commodities, is of advantage to trade. It may be so to that which impoverishes, but not to that which enriches a country. It is indeed less prejudicial, if it lies in *native* than in *foreign* wares; but the humour of *luxury* and expence cannot stop at certain bounds; what begins in *native* will proceed in *foreign* commodities; and though the example arise among idle persons, yet the imitation will run into all degrees, even of those men by whose industry the nation subsists. And besides, the more of *our own* we spend, the less we shall have to send abroad; and so it will come to pass, that while we drive a vast trade, yet, by buying much more than we *sell*, we shall come to be poor at last."

LYBIA, or LIBYA, a name anciently given to all that part of Africa lying between the border of Egypt and the river Triton; and comprehending *Cyrenaica*, *Marmarica*, and the *Regio Syrtica*. See these articles.

LYCÆUM, ΛΥΚΕΙΟΝ, in antiquity, the name of a celebrated school or academy at Athens, where Aristotle explained his philosophy. The place was composed of porticoes, and trees planted in the quincunx form, where the philosophers disputed walking. Hence *philosophy of the Lycæum* is used to signify the philosophy of Aristotle, or the Peripatetic philosophy. Suidas observes, that the Lycæum took its name from its having been originally a temple of Apollo Lycæus; or rather a portico or gallery built by Lycæus son of Apollo: but others mention it to have been built by Pisistratus or Pericles.

LYCÆUS (anc. geog.), a mountain of Arcadia, sacred to Jupiter; whence *Jupiter Lycæus* (Pliny). Sacred also to Pan (Virgil): and hence *Lycaea*, the rites performed to Pan on this mountain; which Evander carrying with him to Latium, were called *Lupercalia* (Virgil).

LYCAON (fab. hist.), the first king of Arcadia, son of Pelagus and Melibœa. He built a town called Lycosura, on the top of mount Lycæus, in honour of Jupiter. He had many wives, by whom he had a daughter called Callisto, and 50 sons. He was succeeded on the throne by Nyctimus, the eldest of his sons. He lived about 1820 years before the Christian æra.—Another king of Arcadia celebrated for his cruelties. He was changed into a wolf by Jupiter, because he offered human victims on the altar of the god Pan. Some attribute this metamorphosis, to another cause. The sins of mankind, as they relate, were become so enormous, that Jupiter visited the earth to punish wickedness and impiety. He came to Arcadia, where he

Lycaonis, was announced as a god, and the people began to pay proper adoration to his divinity. *Lycaon*, however, who used to sacrifice all strangers to his wanton cruelty, laughed at the pious prayers of his subjects; and to try the divinity of the god, he served up human flesh on his table. This impiety so irritated Jupiter, that he immediately destroyed the house of *Lycaon*, and changed him into a wolf.

LYCAONIA, (anc. geog.), a small country of the Hither Asia, contained between Pamphylia to the south, Cappadocia to the north, Phidias and Phrygia to the west, and Armenia Minor to the east. *Lycaones*, the people. This country, though situated very near mount Taurus, and part of it on it, yet the Romans reckoned it into Asia intra Taurum. *Arcaidia*, anciently called *Lycaonia*, (Stephanus.)—Also an island in the Tiber, joined to Rome by a bridge, and to the land by another, namely, the Celsius and Fabricius.

LYCHNIS, CAMPION, in botany, including also the *Bachelor's-button*, (*Catch-fly*, &c: A genus of the pentagynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 22d order, *Caryophyllæ*. The calyx is monophyllous, oblong, and smooth; there are five unguiculated petals; with the segments of the limb almost bifid; the capsule quinquelocular.

Species, &c. 1. The *Chalcedonica*, or *Chalcedonian* scarlet lychnis, hath a fibrated perennial root; upright, straight, hairy, annual stalks, rising three or four feet high; garnished with long, spear-pointed, close-fitting leaves, by pairs opposite; and the stalk crowned by a large, compact, flat bunch of beautiful scarlet or flame-coloured flowers, appearing in June and July. Of this there are varieties, with single scarlet flowers, with large double scarlet flowers of exceeding beauty and elegance, with pale-red flowers, and with white flowers. Of these varieties, the double scarlet lychnis is superior to all for size and elegance: the flowers being large, very double, and collected into a very large bunch, exhibit a charming appearance; the single scarlet kind is also very pretty; and the others effect an agreeable variety with the scarlet kinds. 2. The *diccia*, or *dioecious* lychnis, commonly called *bachelors-button*, hath fibrated perennial roots; upright stalks, branching very diffuse and irregular, two or three feet high; having oval, acute-pointed, rough leaves, by pairs opposite; and all the branches terminated by clusters of dioecious flowers of different colours and properties in the varieties; flowering in April and May. The varieties, are the common single red-flowered bachelors button, double red, double white, and single white-flowered. The double varieties are exceedingly ornamental in their bloom; the flowers large, very double, and continue long in blow; the single red sort grows wild by ditch sides and other moist places in many parts of England; from which the doubles were accidentally obtained by culture in gardens. The flowers are often dioecious, i. e. male and female on distinct plants. 3. The *viscaria*, or *viscous* German lychnis, commonly called *catch-fly*, hath fibry perennial roots; crowned by a tuft of long grassy leaves close to the ground; many erect, straight, single stalks, rising a foot and a half or two feet high, exuding from their

upper part a viscous or clammy matter; garnished with long narrow leaves, by pairs opposite; and terminated by many reddish purple flowers, in clusters one above another, forming a sort of long loose spike; all the flowers with entire petals; flowering in May. Of this also there are varieties with single red flowers, with double red flowers, and with white flowers. The double variety is considerably the most eligible for general culture, and is propagated in plenty by parting the roots. All the varieties of this species emitting a glutinous liquid matter from their stalks, flies happening to light thereon sometimes stick and entangle themselves, whence the plant obtains the name *Catch-fly*. 4. The *flos-cuculi*, cuckoo-flower lychnis, commonly called *ragged-robin*, hath fibry perennial roots; upright, branchless, channelled stalks, rising near two feet high; garnished with long, narrow, spear-shaped leaves, in pairs opposite; and terminated by branchy foot-stalks, sustaining many purple, deeply quadrifid petals; appearing in May. The flowers having each petal deeply quadrifid in a torn or ragged-like manner, the plant obtained the cant name of *Ragged-robin*. There are varieties with single flowers and double flowers. The double sort is a large, very multiple, fair flower: it is an improved variety of the single, which grows wild in most of our moist meadows, and is rarely cultivated; but the double, being very ornamental, merits culture in every garden. All the four species and respective varieties are very hardy; all fibrous-rooted, the roots perennial; but are annual in stalks, which rise in spring, flower in summer, succeeded in the singles by plenty of seed in autumn, by which all the single varieties may be raised in abundance, but the doubles only by dividing the roots, and some by cuttings of the flower-stalks.

LYCIA, a country of Asia Minor, bounded by the Mediterranean on the south, Caria on the west, Pamphylia on the east, and Phrygia on the north. It was anciently called *Milyar*, and *Tremile*, from the *Milyæ*, or *Solyim*, a people of Crete, who came to settle there. The country received the name of *Lycia* from Lycus the son of Pandion, who established himself there. The inhabitants have been greatly commended by all the ancients for their sobriety and justice. They were conquered by Croesus king of Lydia, and afterwards by Cyrus. Though they were subject to the power of Persia, yet they were governed by their own kings, and only paid a yearly tribute to the Persian monarch. They became part of the Macedonian empire when Alexander came into the east, and afterwards were ceded to the house of the Seleucidæ. The country was reduced into a Roman province by the emperor Claudius.

LYCIUM, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 28th order, *Luride*. The corolla is tubular, having its throat closed up with the beard of the filaments; the berry is bilocular. There are eight species, natives of various countries.

LYCODONTES, in natural history, the petrified teeth of the *lupus-piscis*, or wolf-fish, frequently found fossil. They are of different shapes; but the most common kind rise into a semicircular form, and

Lycia
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Lycodontes

Lycome-
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Lycoper-
don.

are hollow within, somewhat resembling an acorn-cup; this hollow is found sometimes empty, and sometimes filled with the stratum in which it is immersed. Many of them have an outer-circle, of a different colour from the rest.

LYCOMEDES, (fab. hist.), a king of Scyros an island in the Ægean sea. He was son of Apollo and Partenopoë. He was secretly entrusted with the care of young Achilles, whom his mother Tethis had disguised in woman's cloaths, to remove him from the Trojan war, where she knew he must unavoidably perish. Lycomedes has rendered himself famous for his treachery to Theseus, who had implored his protection when driven from his throne of Athens by the usurper Mnethus. Lycomedes, as it is reported, either envious of the fame of his illustrious guests, or bribed by the emissaries of Mnethus, led Theseus to an elevated place, on pretence to show him the extent of his dominions, and perfidiously threw him down a precipice, where he was killed.

LYCOPERDON, in botany: A genus of the natural order of fungi, belonging to the cryptogamia class of plants. The fungus is roundish, and full of farinaceous seeds. There are 10 species, of which the following are the most remarkable.

1. The tuber, truffles, or subterraneous puff-balls, is a native of woods both in Scotland and England. It is a subterraneous fungus, growing generally in clusters three or four inches under ground, without any visible root. The figure of it is nearly spherical, the size that of a potato; the exterior coat at first white, afterwards black, and studded with pyramidal or polyhedrous tubercles; the internal substance solid and callous, of a dirty-white or pale-brown colour, grain'd like a nutmeg with serpentine lines; in which, according to Micheli, are imbedded minute oval capsules, containing each from two to four round warted seeds. The truffles of Great Britain seldom exceed three or four ounces in weight; but in Italy, and some other parts of the continent, they are said to have been found of the enormous size of eight and even 14 pounds. They are received at our tables, either fresh and roasted like potatoes, or dried and sliced into ragouts. They have a volatile and somewhat urinous smell, and are reputed to be aphrodisiacal. Dogs are with much pains taught to hunt for them by the scent, and to scratch up the ground under which they lie.

2. The bovista, or common puff-ball, is frequent in meadows and pastures in the autumn. It varies exceedingly in size, figure, superficies, and colour. In general, it consists of a sack or bag, having a root at its base, and the bag composed of three membranes, an epidermis, a tough white skin, and an interior coat which adheres closely to the central pith. The pith in the young plants is of a yellowish colour, at first firm and solid, but soon changes into a cellular spongy substance, full of a dark dull-green powder, which discharges itself through an aperture at the top of the fungus, which aperture is formed of lacerated segments, in some varieties reflexed. The powder is believed to be the seeds, which through a microscope appear of a spherical form, and to be annexed to elastic hairs. See *Haller's Hist. Helvet. n. 2172*.

Among the numerous varieties of this fungus, the glabrum is most remarkable. It is a smooth sessile

kind, of a nearly spherical form, puckered or contracted at the root. This sometimes grows to an enormous size. It has been found in England as big as a man's head; and at Carraria, near Padua in Italy, specimens have been gathered, weighing 25 pounds, and measuring two yards in circumference: but its more ordinary size is that of a walnut or an apple.

The varieties of this species have no limits, being frequently found to run into one another; the scaly, warty, and echinated coats turning smooth as the plants grow old, and the neck of the fungus having no determinate length. The natural colour of the puff-ball is either white, grey, or ash-coloured: but is sometimes found yellowish, tawny, and brownish. The internal spongy part of it, bound on to wounds, is esteemed good to stop bleedings. Pressed and dried in an oven, the puff-ball becomes a kind of tinder, the smoke of which is said to intoxicate bees. See *Cent. Mag. July 1766*. The Italians fry the great variety, and indeed any of the others when young, and eat them with salt and oil, according to the relation of Marigli.

LYCOPERSICON. See SOLANUM.

LYCOPODIUM, or CLUB-MOSS; a genus of the natural order of musci, belonging to the cryptogamia class of plants. The antheræ are bivalved and sessile; there are no calyptra. There are 24 species; of which the following are the most remarkable.

1. The *clavatum*, or common club-moss, is common in dry and mountainous places, and in fir forests. The stalk is prostrate, branched, and creeping, from a foot to two or three yards long; the radicles woody. The leaves are numerous, narrow, lanceolated, acute, often incurved at the extremity, terminated with a long white hair, and every where surround the stalk. The peduncles are erect, firm, and naked (except being thinly set with lanceolate scales), and arise from the ends of the branches. They are generally two or three inches long, and terminated with two cylindrical yellowish spikes, imbricated with oval-acute scales, finely lacerated on the edges, and ending with a hair. In the *ala* or bosom of the scale is a kidney-shaped capsule, which bursts with elasticity when ripe, and throws out a light yellow powder, which, blown into the flame of a candle, flashes with a small explosion. The Swedes make mats of this moss to rub their shoes upon. In Russia, and some other countries, the powder of the capsules is used in medicine to heal galls in children, chops in the skin, and other sores. It is also used to powder over official pills, and to make artificial lightning at theatres. The Poles make a decoction of the plant, and, dipping a linen cloth into it, apply it to the heads of persons afflicted with the disease called the *plica polonica*, which is said to be cured by this kind of fomentation.

2. The *selago*, or fir-club-moss, is common in the Highland mountains of Scotland, and in the Hebrides. The stalk at the base is single and reclining; but a little higher is divided into upright dichotomous branches, from two to six inches high, surrounded with eight longitudinal oblique series of lanceolate, smooth, rigid, imbricated leaves. Near the summits of the branches, in the *ala* of the leaves, are placed single kidney-shaped capsules, consisting of two valves, which open horizontally like the shells of an oyster, and

Lycopodi-
um.

Lycopodi-
um
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Lymphaea

and cast out a fine yellow powder. These capsules Linnaeus supposes to be *anthers*, or male parts of fructification. In the *ale* also of many of the leaves, near the tops of the branches, are often found what the same great author calls *female flowers*, but which the ingenious Haller esteems to be only gems or buds of a future plant. They consist, first, of four stiff, lanceolate, incurved, minute leaves, one of the outermost longer and larger than the rest. These are supposed to correspond to the *calyx* in regular flowers. Again, at the bottom of this *calyx* are five small pellucid substances resembling leaves, visible only by a microscope, which are supposed analogous to pistils. These, in time, grow up into three large broad leaves, two of the five united together like the hoof of an ox; with a third narrower one annexed at the base, and two other minute ones opposite to the other three. These five leaves are joined at the base; and in autumn, falling from the *calyx*, vegetate, and produce a new plant. See a dissertation *De seminibus muscorum, Amanit. Academ.* II. p. 261. In the island of Raafay, near Sky, in Ross-shire, and some other places, the inhabitants make use of this plant instead of alum, to fix the colours in dyeing. The Highlanders also sometimes take an infusion of it as an emetic and cathartic: but it operates violently; and, unless taken in a small dose, brings on giddiness and convulsions. Linnaeus informs us, that the Swedes use a decoction of it to destroy lice on swine and other animals.

LYCOPOLIS, or LYCON, (anc. geog.) so called from the worship of wolves. *Lycopolites*, the people; *Lycopolites*, the district. There were two towns of this name, one in the Delta, or Lower Egypt, near the Mediterranean; the other in the Thebais, or Higher Egypt, in the northern part, to the west of the Nile.

LYCOPHRON, a famous Greek poet and grammarian, born at Colchis in Eubœa, flourished about 304 B. C. and, according to Ovid, was killed by an arrow. He wrote 20 tragedies; but all his works are lost, except a poem intitled *Cassandra*, which contains a long train of predictions, which he supposes to have been made by Cassandra, Priam's daughter. This poem is extremely obscure. The best edition of it is that of Dr Potter, printed at Oxford in 1697, folio.

LYCOPSIS, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 41st order, *Asperifolia*. The corolla has an incurved tube.

LYCOPUS, in botany: A genus of the monogynia order, belonging to the diandria class of plants; and in the natural method ranking under the 42d order, *Verticillata*. The corolla is quadrid, with one of the segments emarginated; the stamina standing a-funder, with four retuse seeds.

LYCURGIA, a festival observed by the Spartans, in memory of their lawgiver Lycurgus, whom they honoured with a temple and anniversary sacrifice.

LYMPHÆA, were artificial caves or grottos amongst the Romans, furnished with a great many tubes, canals, and various hydraulic apparatus, thro' which the water gushed out upon the spectators unexpectedly whilst they were admiring the beautiful arrangement of the shell-work in the grotto.

LYCURGUS, the celebrated legislator of the Spartans, was the son of Enomeus king of Sparta.

—He travelled to Greece, to the isle of Crete, to Egypt, and even to the Indies, to converse with the sages and learned men of those countries, and to learn their manners, their customs, and their laws. After the death of his brother Polydeces, who was king of Sparta, his widow offered the crown to Lycurgus, promising that she would make herself miscarry of the child of which she was pregnant, provided he would marry her; but Lycurgus nobly refused these advantageous offers, and afterwards contented himself with being tutor to his nephew Charillus, and restored to him the government when he came of age; but notwithstanding this regular and generous conduct, he was accused of a design to usurp the crown. This calumny obliged him to retire to the island of Crete, where he applied himself to the study of the laws and customs of nations. At his return to Lacedæmon, he reformed the government; and, to prevent the disorders occasioned by luxury and the love of riches, he prohibited the use of gold and silver; placed all the citizens in a state of equality; and introduced the strictest temperance, the most exact discipline, and those admirable laws which (a few excepted) have been celebrated by all historians. It is said, that, to engage the Lacedæmonians to observe them inviolably, he made them promise with an oath not to change any part of them till his return; and that he afterwards went to the island of Crete, where he killed himself, after having ordered that his ashes should be thrown into the sea, for fear lest if his body should be carried to Sparta the Lacedæmonians would think themselves absolved from their oath. He flourished about 870 B. C.

LYDD, a town of Kent in England, two miles and a half south-west of Romney, of which town and port it is a member, and 71 miles from London. It is a populous town, with a market on Thursday, and fair on July 24th. It is incorporated by the name of a bailiff, elected July 22d, jurats, and commonalty. In the beach near Stone-end, is a heap of stones, fancied to be the tomb of Crispin and Crispianus. And near the sea is a place called *Hobnstone*, consisting of beach and pebble-stones, which abounds nevertheless with holm trees. Here is a charity school.

LYDGATE (John), called the *Monk of Bury*; not, as Cibber conjectures, because he was a native of that place, for he was born about the year 1382, in the village of Lydgate; but because he was a monk of the Benedictine convent at St Edmund's-Bury. After studying some time in our English universities, he travelled to France and Italy; and, having acquired a competent knowledge of the languages of those countries, he returned to London, where he opened a school, in which he instructed the sons of the nobility in polite literature. At what time he retired to the convent of St Edmund's-Bury, does not appear; but he was certainly there in 1415. He was living in 1446, aged about 66; but in what year he died is not known. Lydgate, according to Pits, was an elegant poet, a persuasive rhetorician, an expert mathematician, an acute philosopher, and a tolerable divine. He was a voluminous writer; and, considering the age in which he lived, an excellent poet. His

Lycurgus.
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Lydgate.

Lydia.

language is less obsolete, and his versification much more harmonious, than the language and versification of Chaucer, who wrote about half a century before him. He wrote, 1. History of the Theban war, printed at the end of Chaucer's works, 1561, 16-2, 1687. 2. Poemation of good counsel; at the end of Chaucer's works. 3. The life of Hector; London 1594, fol. printed by Grose, dedicated to Henry V. 3. Life of the Blessed Virgin; printed by Caxton. 4. The proverbs of Lydgate upon the fall of princes; printed by Wink. Word. Lond. . . . 4to. 5. Dispute of the horse, the sheep, and the goose; printed in Caxton's Collect. 4to. 6. The temple of brags; among the works of Chaucer. 7. London liekpenny; vide Stowe's history, &c. &c. Besides an incredible number of other poems and translations preserved in various libraries, and of which the reader will find a catalogue in bishop Tanner.

LYDIA {anc. geog.}, a celebrated kingdom of Asia Minor.—All the ancient writers tell us, that Lydia was first called *Mæonia* or *Mæonia*, from Meon king of Phrygia and Lydia; and that it was known under no other denomination till the reign of Atys, when it began to be called *Lydia* from his son Lydus. Bochart finding in his learned collection of Phœnician words the verb *luz*, signifying "to wind," and observing that the country we are speaking of is watered by the Mæander so famous for its windings, concludes that it was thence named *Lydia*, or *Ludia*. As to the ancient name of *Mæonia*, he takes it to be a Greek translation of the Phœnician word *lud*; wherein he agrees in some measure with Stephanus, who derives the name of *Mæonia* from *Mæon* the ancient name of the Mæander. Some take the word *mæonia* to be a translation of a Hebrew word signifying "metal," because that country, say they, was in former times enriched above any other with mines. Though Lydia and *Mæonia* are by most authors indifferently used for one and the same country, yet they are sometimes distinguished; that part where mount Tmolus stood, watered by the Pactolus, being properly called *Mæonia*; and the other, lying on the coast, *Lydia*. This distinction is used by Homer, Callimachus, Dionysius, and other ancient writers. In after ages, when the Ionians, who had planted a colony on the coast of the Egean Sea, began to make some figure, that part was called *Ionica*, and the name of *Lydia* given to the ancient *Mæonia*.—Lydia, according to Pliny, Ptolemy, and other ancient geographers, was bounded by the Myfia Major on the north, by Caria on the south, by Phrygia Major on the east, and Ionia on the west, lying between the 37th and 39 degrees of north latitude. What the ancients style the kingdom of *Lydia* was not confined within these narrow boundaries, but extended from Halys to the Egean sea. Pliny's description includes *Æolia*, lying between the Hermus and the Caicus.

As to the origin of the Lydians, Josephus, and after him all the ecclesiastic writers, derive them from Lud Shem's fourth son; but this opinion has no other foundation than the similitude of names. Some of the ancients will have the Lydians to be a mixed colony of Phrygians, Mysians, and Carians. Others finding some conformity in religion and religious ceremonies between the Egyptians and Tuscans

Lydia.

who were a Lydian colony, conclude them, without any farther evidence, to be originally Egyptians. All we know for certain is, that the Lydians were a very ancient nation, as is manifest from their very fables; for Atys, Tantalus, Pelops, Niobe, and Arachne, are all said to have been the children of Lydus. And Zanthus in his *Lydiaca*, quoted by Stephanus, informs us, that the ancient city of Alcalon, one of the five fætrapis of the Philistines, mentioned in the books of Joshua and the Judges, was built by one Alcalus a Lydian, whom Achæmus king of Lydia had appointed to command a body of troops which he sent, we know not on what occasion, into Syria. The Heraclidae, or kings of Lydia, descended from Hercules, began to reign before the Trojan war; and had been preceded by a long series of loversigns sprung from Atys, and hence styled *Atyade*: a strong proof of the antiquity of that kingdom.

The Lydians began very early to be ruled by kings whose government seems to have been truly despotic and the crown hereditary. We read of three distinct races of kings reigning over Lydia, viz. the *Atyade*, the Heraclidae, and the Mermnadae.

The *Atyade* were so called from Atys the son of Cotys and grandson of Manes the first Lydian king. But the history of this family is obscure and fabulous.

The *Atyade* were succeeded by the *Heraclidae*, or the descendants of Hercules. For Hercules being, by the direction of the oracle, sold as a slave to Omphale a queen of Lydia to expiate the murder of Iphitus, had, during his captivity, by one of her slaves, a son named *Cleolus*, whose grandson Argon was the first of the Heraclidae that ascended the throne of Lydia. This race is said to have reigned 305 years, the father succeeding the son for 22 generations. They began to reign about the time of the Trojan war. The last of the family was the unhappy Candaules, who lost both his life and kingdom by his imprudence. An event of which we have the following account by Herodotus. Candaules had a wife whom he passionately loved, and believed the most beautiful of her sex. He extolled her charms to Gyges his favourite, whom he used to entrust with his most important affairs; and the more to convince him of her beauty, resolved to show her to him quite naked: he accordingly placed him in the porch of her chamber where the queen used to undress when she went to bed, ordering him to retire after he should have seen her, and take all possible care not to be observed. But notwithstanding all the caution he could use, she plainly discovered him going out; and though she did not doubt but it was her husband's contrivance, yet she passed that night in a seeming tranquillity, suppressing her resentment till next morning, when she sent for Gyges, and resolutely told him that he must either by his death atone for the criminal action he had been guilty of, or put to death Candaules the contriver of it, and receive both her and the kingdom of Lydia for his reward. Gyges at first earnestly begged of her that she would not drive him to the necessity of such a choice. But finding that he could not prevail with her, and that he must either kill his master or die himself, he chose the former part of the alternative. Being led by the queen to the same place where her husband had posted him the night before, he stabbed

Lydia.

bed the king while he was asleep, married the queen, and took possession of the kingdom, in which he was confirmed by the answer of the Delphic oracle. The Lydians having taken up arms to revenge the death of their prince, an agreement was made between them and the followers of Gyges, that if the oracle should declare him to be lawful king of Lydia he should be permitted to reign; if not, he should resign the crown to the Heraclidæ. The answer of the oracle proving favourable to Gyges, he was universally acknowledged for lawful king of Lydia. Candaules is said to have purchased a picture painted by Bupalchus, representing a battle of the Magnes, for its weight in gold; a circumstance which shows how early the art of painting began to be in request, for Candaules was contemporary with Romulus.

Gyges having thus possessed himself of the kingdom of Lydia, sent many rich and valuable presents to the oracle of Delphos, among others, six cups of gold weighing 30 talents, and greatly esteemed for the workmanship. He made war on Miletus and Smyrna, took the city of Colophon, and subdued the whole country of Troas. In his reign, and by his permission, the city of Abydos was built by the Milesians. Plutarch and other writers relate his accession to the crown of Lydia in a quite different manner, and tell us, without making any mention of the queen, that Gyges rebelled against Candaules and slew him in an engagement. In Gyges began the third race called *Mermade*; who were also, properly speaking, Heraclidæ, being descended from a son of Hercules by Omphale. Gyges reigned 38 years, and was succeeded by his son Ardyes.

This prince carried on the war against the Milesians which his father had begun, and possessed himself of Priene, in those days a strong city. In his reign the Cimerians invaded and over-run all Asia Minor; but what battles were fought between the Lydians and these invaders, and with what success, we find no where mentioned. Herodotus only informs us, that in the time of Ardyes they possessed themselves of Sardis, the metropolis of Lydia, but could never reduce the castle. Ardyes reigned 49 years, and was succeeded by his son Sadyattes, who reigned 12 years, and warred most part of his reign with the Milesians.

After him came his son Alyattes, who for the space of five years continued the war which his father had begun against the Milesians, ravaging their country, and about harvest time carrying away all their corn yearly, in order to oblige them, for want of provisions, to surrender their city, which he knew he could not reduce any other way, the Milesians being at that time masters of the sea. In the 12th year of this war the Lydians having set fire to the corn in the fields, the flames were carried by a violent wind, which happened to blow at that time, to the temple of Minerva at Assesus, and burnt it down to the ground. Not long after, Alyattes falling sick, sent to consult the oracle at Delphos; which refused to return any answer till such time as the king should rebuild the temple of Minerva at Assesus. Alyattes, thus warned, dispatched ambassadors to Miletus, enjoining them to conclude a truce with the Milesians till the temple should be rebuilt. On the arrival of the ambassadors, Thrasybulus, then king of Miletus, commanded all

Lydia.

the corn that was at that time in the city to be brought into the market-place, ordering the citizens to banquet in public, and revel as if the city were plentifully stored with all manner of provisions. This stratagem Thrasybulus practised, to the end that the ambassadors seeing such quantities of corn, and the people every where diverting themselves, might acquaint their master with their affluence, and divert him from pursuing the war. As Thrasybulus had designed, so it happened; for Alyattes, who believed the Milesians greatly distressed for provisions, receiving a different account from his ambassadors, changed the truce into a lasting peace, and ever afterwards lived in amity and friendship with Thrasybulus and the Milesians. He was succeeded, after a reign of 57 years, by his son Cressus, whose uninterrupted prosperity, in the first years of his reign, far eclipsed the glory of all his predecessors. He was the first that made war on the Ephesians, whose city he besieged and took notwithstanding their consecrating it to Diana, and fastening the walls by a rope to her temple, which was seven stadia distant from the city. After the reduction of Ephesus, he attacked, under various pretences, the Ionians and Æolians, obliging them, and all the other Greek states of Asia, to pay him a yearly tribute. Having met with such extraordinary success by land, the Lydian prince determined to render his power equally conspicuous by sea. For this purpose he thought seriously of equipping a fleet; with which he purposed to invade and conquer the Grecian islands directly fronting his dominions. But this design, which, considering the slow progress in maritime power among the nations most diligent to attain it, would probably have failed of success, was prevented by the advice of a philosophical traveller conveyed in such a lively turn of wit, as easily changed the resolution of the king. Bias of Priene in Ionia, some say Pittacus of Mitylene in the isle of Lesbos, while he travelled after the Grecian custom, from curiosity and a love of knowledge, was presented to Cressus at the Lydian court; and being asked by that prince what news from Greece; he answered with a republican freedom, that the islanders had collected powerful squadrons of cavalry with an intention of invading Lydia. "May the gods grant (said Cressus), that the Greeks, who are unacquainted with horsemanship, should attack the disciplined valour of the Lydian cavalry; there would soon be an end to the contest." "In the same manner (replied Bias), as if the Lydians, who are totally unexperienced in naval affairs, should invade the Grecians by sea." Struck by the acuteness of this unexpected observation, Cressus desisted from his intended expedition against the islands, and instead of employing new means for extending his conquests, determined peaceably to enjoy the laurels which he had won, and to display the grandeur which he had attained. But his happiness was soon after allayed by the death of his favourite son Atys, who was unfortunately killed at the chase of a wild boar. For this loss he continued disconsolate for two years and in a state of inaction, till the conquests of Cyrus, and growing power of the Persians, roused up his martial spirit, and diverted his mind to other thoughts. He apprehended that the success which attended Cyrus in all his undertakings, might at last prove

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Lydia.

prove dangerous to himself, and therefore resolved to put a stop, if possible, to his progress. In taking this resolution, which might probably be attended with the most important consequences, he was desirous to learn the will of heaven concerning the issue of the war. The principal oracles which he consulted were those of Branchis in Ionia, of Hammon in Libya, and of Delphi in Greece. Among these respected shrines, the oracle of Delphi maintained its ascendancy, as the most faithful interpreter of fate. Cræsus was fully persuaded of its veracity; and desirous generously to compensate for the trouble which he had already given, and still meant to give, the priests of Apollo, he sacrificed 3000 oxen to the god, and adorned his shrine with dedications equally valuable for the workmanship and for the materials; precious vessels of silver, ewers of iron beautifully inlaid and enamelled; various ornaments of pure gold, particularly a golden lion weighing ten talents, and a female figure three cubits or near five feet high. In return for these magnificent presents, the oracle, in ambiguous language, flattered Cræsus with obtaining an easy victory over his enemies, and with enjoying a long life and a prosperous reign. The god at the same time enjoined him to contract an alliance with the most powerful of the Grecian states.

Elevated with these favourable predictions of Apollo, Cræsus prepared to yield a ready obedience to the only condition required on his part for the accomplishment of his aspiring purpose. Not deeming himself sufficiently acquainted with the affairs of Greece, to know what particular republic was meant by the oracle, he made particular inquiry of those best informed concerning the state of Europe; and discovered, that among all the members of the Grecian confederacy, the Athenians and Lacedæmonians were justly intitled to the pre-eminence. In order to learn which of these communities deserved the epithet of *most powerful*, it was necessary to send ambassadors into Greece. The Lydians dispatched with this important commission, soon discovered that the Athenians, after having been long harassed by internal dissensions, were actually governed by the tyrant Pisistratus. The Spartans, on the other hand, though anciently the worst regulated of all the Grecian communities, had enjoyed domestic peace and foreign prosperity ever since they had adopted the wise institutions of Lycurgus. After that memorable period, they had repeatedly conquered the warlike Argives, triumphed over the hardy Arcadians; and notwithstanding the heroic exploits of Aristomenes, subdued and enslaved their unfortunate rivals of Messene. To the Lydian ambassadors, therefore, the Spartan republic appeared to be pointed out by the oracle as the community whose alliance they were enjoined to solicit. Having repaired accordingly to Sparta, they were introduced not only to the kings and senate, but, as the importance of the negotiation required, to the general assembly of the Lacedæmonians, to whom they, in few words, declared the object of their commission: "We are sent, O Lacedæmonians! by Cræsus, king of the Lydians and of many other nations, who being commanded by the oracle of Apollo to seek the friendship of the most powerful people of Greece, now summons you, who justly merit that epithet, to become his faithful allies, in obedience to the

will of the god whose authority you acknowledge." Lydia. The Lacedæmonians, pleased with the alliance of a warlike king, and still more with the fame of their valour, readily accepted the proposal. To the strict connection of an offensive and defensive league, they joined the more respected ties of sacred hospitality. A few years before this transaction, they had sent to purchase gold at Sardis for making a statue of Apollo. Cræsus had on that occasion gratuitously supplied their want. Remembering this generosity, they gave the Lydian ambassadors at their departure, as a present for their master, a vessel of brass containing 300 amphoras (above 12 hogheads), and beautifully carved on the outside with various forms of animals.

Cræsus, having thus happily accomplished the design recommended by the oracle, was eager to set out upon his intended expedition. He had formerly entered into alliance with Amasis king of Egypt, and Labynetus king of Babylon. He had now obtained the friendship of the most warlike nation of Europe. The newly-raised power of Cyrus and the Persians seemed incapable of resisting such a formidable confederacy.

Elevated with these flattering ideas of his own invincible greatness, Cræsus waited not to attack the Persian dominions until he had collected the strength of his allies. The sanguine impetuosity of his temper, unexperienced in adversity, unfortunately precipitated him into measures no less ruinous than daring. Attended only by the arms of Lydia, and a numerous band of mercenaries, whom his immense wealth enabled him at any time to call into his service, he marched towards the river Halys; and having crossed with much difficulty that deep and broad stream, entered the province of Cappadocia, which formed the western frontier of the Median dominions. That unfortunate country soon experienced all the calamities of invasion. The Pterian plain, the most beautiful and the most fertile district of Cappadocia, was laid waste; the ports of the Euxine, as well as several inland cities, were plundered; and the inoffensive inhabitants were either put to the sword or dragged into captivity. Encouraged by the unresisting softness of the natives of those parts, Cræsus was eager to push forwards; and if Cyrus did not previously meet him in the field, he had determined to proceed in triumph to the mountains of Persia. Against this dangerous resolution he was in vain exhorted by a Lydian named Sandanis; who, when asked his opinion of the war, declared it with that freedom which the princes of the East have in every age permitted, amidst all the pride and caprices of despotic power, to men distinguished by the gifts of nature or education. "You are preparing, O king, to march against a people who lead a laborious and a miserable life; whose daily subsistence is often denied them, and is always scanty and precarious; who drink only water, and who are clothed with the skins of wild beasts. What can the Lydians gain by the conquest of Persia; they who enjoy all the advantages of which the Persians are destitute? For my part, I deem it a blessing of the gods, that they have not excited the warlike poverty of these miserable barbarians to invade and plunder the luxurious wealth of Lydia." The moderation of this advice was rejected by the fatal presumption of Cræsus; who confounding the

Lydia.

the dictates of experienced wisdom with the mean suggestions of pusillanimity, dismissed the counsellor with contempt.

Meanwhile, the approach of Cyrus, who was not of a temper to permit his dominions to be ravaged with impunity, afforded the Lydian king an opportunity of bringing the war to a more speedy issue than by his intended expedition into Persia. The army of Cyrus gradually augmented on his march; the tributary princes cheerfully contributing with their united strength towards the assistance of a master whose valour and generosity they admired, and who now took arms to protect the safety of his subjects, as well as to support the grandeur of his throne. Such was the rapidity of his movement, especially after being informed of the destructive ravages of the enemy in Cappadocia, that he arrived from the shores of the Caspian to those of the Euxine Sea before the army of Croesus had provided the necessaries for their journey. That prince, when apprised of the neighbourhood of the Persians, encamped on the Persian plain; Cyrus likewise encamped at no great distance: frequent skirmishes happened between the light troops; and at length a general engagement was fought with equal fury and perseverance, and only terminated by the darkness of night. The loss on both sides hindered a renewal of the battle. The numbers, as well as the courage of the Persians, much exceeded the expectation of Croesus. As they discovered not any intention to harass his retreat, he determined to move back towards Sardis, to spend the winter in the amusements of his palace; and after summoning his numerous allies to his standard, to take the field early in the spring with such increase of force as seemed sufficient to overpower the Persians.

But this design was defeated by the careful vigilance of Cyrus. That experienced leader allowed the enemy to retire without molestation; carefully informing himself of every step which they took, and of every measure which they seemed determined to pursue. Patiently watching the opportunity of a just revenge, he waited until Croesus had re-entered his capital, and had disbanded the foreign mercenaries, who composed the most numerous division of his army. It then seemed the proper time for Cyrus to put his Persians in motion; and such was his celerity, that he brought the first news of his own arrival in the plain of Sardis. Croesus, whose firmness might well have been shaken by the imminence of this unforeseen danger, was not wanting on the present occasion to the duties which he owed to his fame and the lustre of the Lydian throne. Though his mercenaries were disbanded, his own subjects, who served him from attachment, who had been long accustomed to victory, and who were animated with a high sense of national honour, burned with a desire of enjoying an opportunity to check the daring insolence of the invaders. Croesus indulged and encouraged this generous ardour. The Lydians in that age fought on horseback, armed with long spears; the strength of the Persians consisted in infantry. They were so little accustomed to the use of horses, that camels were almost the only animals which they employed as beasts of burden. This circumstance suggested to a Mede, by name Harpagus, a stratagem, which

Vol. X. Part I.

Lydia.

being communicated to Cyrus, was immediately adopted with approbation by that prince. Harpagus, having observed that horses had a strong aversion to the shape and smell of camels, advised the Persian army to be drawn up in the following order: All the camels which had been employed to carry baggage and provisions were collected into one body, arranged in a long line fronting the Lydian cavalry. The foot soldiers of the Persians were posted immediately behind the line, and placed at a due distance. The Median horse (for a few squadrons of these followed the standard of Cyrus) formed the rear of the army. As the troops on both sides approached to join battle, the Lydian cavalry, terrified at the unusual appearance of the camels, mounted with men in arms, were thrown into disorder, and turning their heads, endeavoured to escape from the field. Croesus, who perceived the confusion, was ready to despair of his fortune; but the Lydians, abandoning their horses, prepared with uncommon bravery to attack the enemy on foot. Their courage deserved a better fate; but unaccustomed as they were to this mode of fighting, they were received and repelled by the experienced valour of the Persian infantry, and obliged to take refuge within the fortified strength of Sardis, where they imagined themselves secure. The walls of that city bid defiance to the rude art of attack, as then practised by the most warlike nations. If the Persian army should invest it, the Lydians were provided with provisions for several years; and there was reason to expect, that in a few months, and even weeks, they would receive such assistance from Egypt, Babylonia, and Greece (to which countries they had already sent ambassadors), as would oblige the Persians to raise the siege.

The Lydian ministers dispatched into Greece met with great sympathy from the Spartans. That people were particularly observant of the faith of treaties; and while they punished their enemies with unexampled severity, they behaved with generous compassion towards those whom they had once accepted for allies. They immediately resolved therefore to send him a speedy and effectual relief; and for this purpose assembled their troops, made ready their vessels, and prepared every thing necessary for the expedition.

The valour of the Spartans might perhaps have upheld the sinking empire of Lydia; but before their armament could set sail, Croesus was no longer a sovereign. Notwithstanding the strength of Sardis, that city had been taken by storm on the 20th day of the siege; the walls having been scaled in a quarter which, appearing altogether inaccessible, was too carelessly guarded. This was effected by the enterprise of Hydrades a Mede, who accidentally observed a sentinel descend part of the rock in order to recover his helmet. Hydrades was a native of the mountainous province of Mardia, and being accustomed to clamber over the dangerous precipices of his native country, resolved to try his activity in passing the rock upon which he had discovered the Lydian. The design was more easily accomplished than he had reason to expect: emulation and success encouraged the bravest of the Persians to follow his example; these were supported by greater numbers of their countrymen; the garrison of Sardis was surprised; the citadel stormed;

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the rich capital of Lower Asia subjected to the vengeful rapacity of an indignant victor. Thus ended the ancient kingdom of Lydia, which continued subject to the Persians till they also were conquered by the Macedonians.—For the fate of the Lydian monarch, see the article CROESUS.

LYDIAT (Thomas), a learned English divine, born in 1572, and educated at Oxford. About the year 1609, he became acquainted with Dr James Usher, afterwards archbishop of Armagh, who carried him to Ireland. He was at Dublin college for about two years, after which he returned to England; and the rectory of Alkington becoming vacant, he was presented to it: but at length, being engaged for the debts of a near relation, which for the present he was unable to pay, having before spent his patrimony in printing several books, he was sent to prison; and was confined at Oxford, in the King's-bench, and elsewhere, till Sir William Boswell, a generous patron of learned men, Dr Robert Pink, warden of New-college, bishop Usher, and Dr Laud, discharged the debt. In the civil wars, he suffered much in his rectory of Alkington from the parliament-party; was four times pillaged to the value of at least 70l.; and was forced for a quarter of a year together to borrow a shirt to shift himself. He died in 1646. He wrote some pieces in English, and many works in Latin, on chronology and natural history.

LYDIUS LAPIS, in the natural history of the ancients; the name of the stone used by way of touchstone for the trial of gold and silver, and called by some *Heraculus lapis*; both of which names were also applied by the ancients to the load-stone; and hence has arisen no small misunderstanding of their works. Pliny has observed, that both the load-stone and touch-stone were at times called *Lydius* and *Heraculus lapis*.

The true *lapis Lydius*, or the touchstone, was anciently found only in the river Tmolus; but was afterwards found in many other places, and is now very common in many of the German rivers. The ancients give us very remarkable and circumstantial accounts of the uses they made of it; and it is plain they were able to discern the alloys of gold by means of it with very great exactness. We at present use several different stones under this name, and for the same purpose. In Italy, a green marble called *verdello*, is most frequently used; and with us, very frequently small pieces of the *basaltes*, the same with that vast piece of black marble called the *Giant's Causeway* in Ireland. See *BASALTES*; *GIANT'S Causeway*; *ICELAND*, n°5; *STAFFA*; and *VOLCANO*.

LYGEUM, in botany; a genus of the monogynia order, belonging to the triandria class of plants; and in the natural method ranking under the fourth order, *Gramina*. The spathe or sheath is monophyllous; there are a pair of corollæ upon the same gemma; the nut is bilocular.

LYGII, *LIGII*, *Lugii*, or *Logiones* (anc. geog.), a people of Germany, to the west of the Vistula, where it forms a bend like a crescent; *Ligii*, (Dio); *Lugii*, (Strabo); *Logiones*, (Zosimus). Their name *Lugii* is conjectured to be derived from their mutually close confederacy or league. The Vistula was their boundary to the north, east, and south, with mount Afc-

burgius to the west. Now the whole of that country lies in Poland, on this side the Vistula.

LYING-IN-WOMEN. See MIDWIFERY.

LYING-TO, or *LYING-BY*, the situation of a ship, when she is retarded in her course, by arranging the sails in such a manner as to counteract each other with nearly an equal effort, and render the ship almost immovable, with respect to her progressive motion, or head-way. A ship is usually brought-to by the main and fore-top sails, one of which is laid aback, whilst the other is full; so that the latter pushes the ship forward, whilst the former resists this impulse by forcing her astern. This is particularly practised in a general engagement, when the hostile fleets are drawn up in two lines of battle opposite each other. It is also used to wait for some other ship, either approaching or expected; or to avoid pursuing a dangerous course, especially in dark or foggy weather, &c.

LYME-REGIS a sea-port town of Dorsetshire in England, 148 miles from London. It lies near the sea, on the very borders of Devonshire, in a cavity between two rocky hills, which makes it difficult of access. It is about five furlongs long, and contains about 200 houses. As it lies on the declivity of a hill, the houses make a good show, one above another; and some of them are built of freestone, and covered with blue slate. The corporation consists of a mayor (who is justice of peace during his mayoralty and the year after, and in the third year both justice and coroner), a recorder, 15 capital burgesses, and a town-clerk. This place had formerly a very flourishing trade to France, Spain, the Straits, Newfoundland, and the West Indies; during which, the customs amounted some years to 16,000l. But it stands on such a high steep rock, that the merchants are obliged to load and unload their goods at a place a quarter of a mile off, called the *Cobb*, originally built in the reign of Edward III. which costs a great sum to maintain, but forms such a harbour as perhaps is not to be equalled in the world, the ships being sheltered by a high thick stone wall, raised in the main sea a good way from the shore, broad enough for carriages and warehouses, and the custom-house officers have one upon it. The cellars of the low part of the town, near the sea, are however often overflowed by the spring-tides 10 or 12 feet. There are guns planted for defence both of the Cobb and the town, the shore here being very proper for batteries. The custom-house stands on pillars, with the corn-market under it. There is an alms-house in church-street, also Presbyterian and Anabaptist meeting-houses. The town-hall is near Broad-street. The church stands at the east end of the town on a rising ground. The market here is Friday, and there are two fairs in the year. We read, that, in 774, the Saxon King Kinwulf gave land hereabouts to the church of Sherborn, for the boiling of salt there to supply its necessities. At this place the duke of Monmouth landed in 1685. A few years ago above 2000l. worth of gold and silver coin of Char. I. and II. were discovered by some labourers.

LYMINGTON, a borough-town of Hampshire in England, 97 miles south-west of London. It stands about a mile from the channel, running between the main land and the isle of Wight; and has a harbour

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Lymington.

Lymph || **Lyncurius.** for vessels of considerable burden. The tide flows near a mile above the town. It has a market on Saturdays, and two fairs in the year; and sends two members to parliament.

LYMPH, a fine colourless fluid, separated in the body from the mass of blood, and contained in peculiar vessels called *lymphatics*. See **ANATOMY**.

LYMPHATI, was a name given by the Romans to such as were seized with madness. It is supposed to be used for *Nymphati*, because the ancients imagined that every person who had the misfortune to see a nymph was instantly struck with phrenzy. *Lymphati* may indeed signify "madmen," as derived from *lymphos*, "water" over which element the nymphs were thought to preside: But it appears most likely, that distracted people were called *lymphati*, from the circumstance of madmen's being affected with the *hydrophobia* or dread of water after the bite of a mad dog; for this peculiarity, in cases of canine madness, was not unknown to the Romans.

LYNCEUS, in fabulous history, one of the 50 sons of *Ægeus*, married *Hypermetra*, one of the 50 daughters of *Danaus*. See **HYPERMETRA**.

LYNCEUS, in fabulous history, one of the Argonauts, who went with *Jason* in the expedition to obtain the golden fleece. He was of great use to the Argonauts, by enabling them to avoid the sand-banks and rocks they found in their way. The poets say, that *Lynceus* had so piercing a sight, that it could not only penetrate to the bottom of the sea, but even to hell. Some mythologists suppose, that this fable is taken from *Lynceus's* skill in observing the stars, and discovering the mines of gold and silver concealed in the earth.

LYNCURIUM, a stone thought to be the same with the tourmalin. The name is derived from *lynx*, "lynx," and *ur*, "urine."

LYNCURIUS LAPIS, a stone capable of producing mushrooms.

In the *Ephemerides* of the *Carious* we find mention made of a stone, so called by *Dr John George Wolckamerus*, who saw one in Italy, which never ceases to produce in a few days mushrooms of an excellent flavour by the most simple and easy process imaginable. "It is," says he, "of the bigness of an ox's head, rough and uneven on its surface, and on which also are perceived some clefts and crevices. It is black in some parts, and in others of a lighter and greyish colour. Internally it is porous, and nearly of the nature of the pumice-stone, but much heavier; and it contains a small piece of flint, which is so incorporated with it as to appear to have been formed at the same time the stone itself received its form. This gives room to judge, that those stones have been produced by a fat and viscid juice, which has the property of indurating whatever matter it filtrates into. The stone here spoken of, when it has been lightly covered with earth, and sprinkled with warm water, produces mushrooms of an exquisite flavour, which are usually round, sometimes oval, and whose borders, by their inflexions and different curvities, represent in some measure human ears. The principal colour of these mushrooms is sometimes yellowish, and sometimes of a bright purple; but they are always disseminated with distinct spots, of a deep orange colour, or red brown;

and when these spots are recent, and still in full bloom, they produce a very agreeable effect to the sight. But what appears admirable is, that the part of the stalk which remains adhering to the stone, when the mushroom has been separated from it, grows gradually hard, and petrifies in time, so that it seems that these fungites restore to the stone the nutritive juice it received from it, and that it thus contributes to its increase." *Joha Baptist Porta* pretends, that this stone is found in several parts of Italy; and that it is not only to be met with at Naples, taken out of mount *Vesuvius*, but also on mount *Pantherico*, in the principality of *Arelino*; on mount *Garganus*, in *Apulia*; and on the summit of some other very high mountains. He adds, that the mushrooms which grow on those sorts of stones, and are usually called *fungi lyncurii*, have the property of dissolving and breaking the stone of the kidneys and bladder; and that, for this purpose, nothing more is required than to dry them in the shade, and being reduced to powder, to make the patient, fasting, take a sufficient quantity of this powder in a glass of white-wine, which will so cleanse the excretory ducts of the urine, that no stones will ever after be collected in them. As to the form of those mushrooms, their root is stony, uneven, divided according to its longitudinal direction, and composed of fibres as fine as hairs, interwoven one with another. Their form, on first shooting out, resembles a small bladder, scarce then larger than the bud of a vine; and if in this state they are squeezed between the fingers, an aqueous subacid liquor issues out. When they are at their full growth, their pedicle is of a finger's length, larger at top than at bottom, and becomes insensibly slender in proportion as it is nearer the earth. These mushrooms are also formed in an umbella, and variegated with an infinity of little specks situated very near one another. They are smooth and even on the upper part, but underneath leafy like the common mushrooms. Their taste is likewise very agreeable, and the sick are not debarred eating of them when they have been dressed in a proper manner. Curiosity having prompted some naturalists and physicians to submit these stones to a chemical analysis, in order to be more competent judges of the uses they might be put to in medicine, there first came forth, by distillation, an insipid water, and afterwards a spirituous liquor. The retort having been heated to a certain point, there arose an oil, which had nearly the smell and taste of that of *guaiacum*; and a very acid salt was extracted from the ashes.

LYNN-REGIS, a town of Norfolk, in England, distant 98 miles from London. It is a handsome, large, well-built place, and sends two members to parliament. It was a borough by prescription in 1298. *King John*, on account of its adherence to him against the barons, made it a free borough, with large privileges. He appointed it a provost, and gave it a large silver cup of 73 ounces doubly gilt and enamelled, and a large silver sword that is carried before the mayor; though this last, according to some, is *Henry VIII's* sword, which he gave to the town when it came into his hands by exchange with the bishop of *Norwich*; after which it was called *King's Lynn*; whereas before it was *Bishop's Lynn*. *Henry III.* made it a mayor-town, for its serving him against the barons.

Lynn-regis It has had 15 royal charters; and is governed by a mayor, high-steward, under-steward, recorder, 12 aldermen, and 18 common-council men. It has two churches, besides St Nicholas, a chapel of ease to St Margaret's, a prebiterian and a quakers meeting-house, with a bridewell or workhouse, and several alms-houses, and a free-school. In September 1741 the spires of its two churches were both blown down by a storm of wind; and that of St Margaret's, which was 193 feet in height, having beat in the body of the church, it has been since rebuilt, towards which king George II. gave L. 1000, and the late earl of Orford, then Sir Robert Walpole, L. 500. This church was formerly an abbey, and afterwards one of the largest parish-churches in England. The town-house, called Trinity-hall, is a noble old fabric; and so is the Exchange, which is of free-stone, with two orders of columns. St Nicholas's chapel is very ancient, and reckoned one of the fairest and largest of the kind in England. It has a bell-tower of free-stone, and an eight-square spire over it, both which together are 170 feet from the ground. There is a library in it that was erected by subscription; and there is another at St Margaret's. Here have been formerly several monasteries; but the only fabric remaining that belongs to any religious order is the Grey-friars steeple, a noted sea-mark. The situation of this town, near the fall of the Ouse into the sea, after having received several other rivers, of which some are navigable, gives it an opportunity of extending its trade into eight different counties; by which many considerable cities and towns, viz. Peterborough, Ely, Stamford, Bedford, St Ives, Huntingdon, St Neot's, Northampton, Cambridge, St Edmundsbury, and the north part of Bucks, as well as the inland parts of Norfolk and Suffolk, are supplied with heavy goods, not only from our own produce, as coals and salt from Newcastle, but also of merchandize imported from abroad, especially wine; of which two articles, viz. coals and wine, this is the greatest port for importation of any place on all the eastern coast of England; and those wherein the Lynn merchants deal more largely than any town in England, except London, Bristol, and Newcastle. In return for this, Lynn receives back all the corn which the counties just mentioned produce, for exportation; and therefore sends more of it abroad than any port except Hull. The foreign trade of the merchants here is very considerable, especially to Holland, Norway, and the Baltic, and also to Spain and Portugal; and formerly they drove a good trade to France, till it was turned off, by treaties on one hand, and by prohibitions, high duties, &c. on the other, to Spain and Portugal. The harbour is safe when ships are in it, but difficult to enter by reason of the many flats and shoals in the passage; which, however, are well buoyed, and good pilots are always ready. The town consists of about 2400 houses; and appears to have been very strong, by the ruins of the works demolished in the civil wars. St Ann's platform at the north end mounts 12 great guns, and commands all the ships passing near the harbour; and towards the land, besides the wall, there is a ditch. Four rivulets run through the town; and the tide of the Ouse, which is about as broad here as the Thames at London-bridge, rises 20 feet

perpendicular. In the great market-place a statue of king James II. was erected in 1686 to the honour of king James II. There is another spacious market-place, adorned with a statue of king William III. and a fine cros with a dome and gallery round it supported by 16 pillars. The market-house is of free-stone, supported by 16 columns; and is 70 feet high, erected on four steps, neatly adorned with statues, &c. Every first Monday in the month, the mayors, aldermen, preachers, &c. meet to hear and determine all controversies amicably, for preventing law-fuits. This was first established in 1588, and is called *The Feast of Reconciliation*. The markets are on Tuesdays and Saturdays; and it has two fairs: one of which, beginning Feb. 14. lasts for a fortnight, and is called *Lynn-mart*; the other is a cheese-fair on Oct. 6. The adherence of this town to king John and to Henry VIII. as above mentioned, are not the only instances of its loyalty to its sovereigns; for, in the late civil wars, it held out for king Charles I. and sustained a formal siege of above 18,000 men of the parliament-army, for above three weeks; but, for want of relief, was obliged to surrender, and submit to the terms of paying 10s. a-head for every inhabitant, and a month's pay to the soldiers, to save the town from plunder. There are more gentry, and consequently more gaiety, in this town than in Yarmouth or even Norwich; there being such plenty of cates and drinkables, that Spelman says Ceres and Bacchus seem to have established their magazines at this place; the east side abounding with corn, sheep, rabbits, hares, &c. the west side with cheese, butter, black-cattle, swans, and the wild-fowl common to marshes, besides the abundance of sea and river fish; so that he thinks there is no place in Great Britain, if in Europe, has such a variety in so small a compass of ground. At a small distance from the town stands a mount called the Lady's or Red Mount, where was once a chapel dedicated to the Virgin Mary, which was a resting-place for pilgrims on their way towards her convent at Walsingham. The king's stait-yard, or quay, where the greatest part of the imported wines is landed and put into large vaults, is a handsome square, with brick buildings, in the centre whereof is a statue of king James I. People pass hence into the fen-country, and over the famous washes into Lincolnshire in boats, which are often lost, by venturing out at an improper season and without guides.

LYNX, in zoology. See FELIS.

LYON King of Arms. See KING; and LAW, n° clviii. 16.

This office is of great antiquity and respect in Scotland; and although the precise time of its institution is unknown, yet it must have been as early as the introduction of armorial figures as hereditary marks of gentility and distinction into this country, which was in the 12th century. His regalia are, a crown of gold, with a crimson velvet-cap, a gold tassel, and an ermine lining; a velvet-robe reaching to his feet, with the arms of the kingdom embroidered thereon before and behind in the proper tinctures; a triple row of gold chain round his neck, with an oval gold medal pendent thereto, on one side of which is the royal bearing, and on the other St Andrew with his cross enamelled in proper colours, and a baton of gold enamelled green, powdered

Lynn-regis
Lyon.

Lyonet.

Lyonet.

dered with the badges of the kingdom. The Lord Lyon's rank is superior to that of any other king of arms, as he holds his office immediately from the sovereign by commission under the great seal; whereas the kings of arms in England are deputies to the Earl Marshal, and act under his authority. Formerly Scotland was divided into two provinces, the one on the north and the other on the south side of Forth; and these provinces were under the management of two deputies appointed by the Lord Lyon to superintend the execution of all the business of his office. Before the revolution, the Lord Lyon, at his admission into office, was most solemnly crowned by the sovereign or his commissioner, in presence of the nobility, the officers of state, and other great men, after a suitable sermon preached in the royal chapel; and his crown was of the same form with the imperial crown of the kingdom. On solemn occasions he wears the regalia above described; at all other times, he wears the oval gold medal or badge on his breast, suspended by a broad green ribbon. He has the absolute disposal of all the offices in his own court, and of the heralds and pursuivants places. The messengers at arms throughout Scotland are also created by him, and are amenable to his jurisdiction. And the powers vested in him by his commission are the same with those of the sovereign in all matters relative to the marks of gentility.

LYONET (Peter), an ingenious naturalist, and member of several learned societies, was born at Maftricht, and was descended from a very ancient and respectable family of Lorraine. He had scarcely attained his seventh year before he displayed an uncommon strength and agility in all bodily exercises; but he was not less diligent in the improvement of his mind. Being placed at the Latin school, he learned chronology, and exercised himself in Latin, Greek, and French poetry, as also in Hebrew, logic, and the Cartesian Physics. He was particularly fond of the study of languages, whereof he understood no less than nine, living and dead. Having entered the university of Leyden, he studied the Newtonian philosophy, geometry, algebra, &c.; but his father (who was a clergyman), desiring he should attach himself to divinity, he reluctantly abandoned the former studies, as his passion for them was not easily to be overcome. He at the same time applied himself to anatomy, and also to music and drawing. He began afterwards to practise sculpture: and performed several pieces in wood, some of which are preserved, and have been greatly admired by the artists. After this, he betook himself to drawing portraits of his friends from life; wherein, after three or four months practice, he became a great proficient. Having attained the degree of candidate in divinity, he resolved to study law, to which he applied himself with so much zeal, that he was promoted at the end of the first year. Arrived at the Hague, he undertook the study of decyphering; and became secretary of the cyphers, translator of the Latin and French languages, and patent-master, to their High Mightinesses. Meanwhile, having taken a strong liking to the study of insects, he undertook an historical description of such as are found about the Hague, and to that end collected materials for several volumes; and having invented a method of drawing adapted thereto,

he enriched this work with a great number of plates, universally admired by all the connoisseurs who had seen them. In the year 1742 was printed at the Hague a French translation of a German work, the 'Theology of Insects,' by Mr Lesser. Love of truth engaged Mr Lyonet to defer the publication of his above-mentioned description, and to make some observations on that work, to which he has added two most beautiful plates, engraved from his designs. This performance caused his merit to be universally known and admired. The celebrated M. de Reaumur had the above translation reprinted at Paris, not so much on account of the work itself as of Mr Lyonet's observations; and bestowed on it, as did also many other authors, the highest encomiums. He afterwards executed drawings of the fresh-water polytus for Mr Trembley's beautiful work, 1744. The ingenious Wandelaar had engraved the first five plates; when Mr Lyonet, who had never witnessed this operation, concerned at the difficulties he experienced in getting the remaining eight finished in the superior style he required, resolved to perform the task himself. He accordingly took a lesson of one hour of Mr Wandelaar, engraved three or four small plates, and immediately began upon the work itself, which he performed in such a manner as drew on him the highest degree of praise, both from Mr Trembley and from many other artists, particularly the celebrated Van Gool; who declared that the performance astonished not only the amateurs, but also the most experienced artists. In 1748 he was chosen member of the Royal Society of London. In 1749 he began (by mere chance) his amazing collection of horns and shells, which, according to the universal testimony of all travellers and amateurs who have visited it, is at present the most beautiful, and certainly one of the most valuable, in Europe. In 1753, he became member of the newly-established Dutch Society of Sciences at Haerlem; and in 1757, after the celebrated M. le Cat, professor in anatomy and surgery, and member of almost all the principal societies in Europe, had seen Mr Lyonet's incomparable *Traité Anatomique de la Chèvre qui ronge le Bois de Saul*, with the drawings belonging to it (which work was afterwards published), he was elected member of the Royal Academy of Sciences of Rome, whereof M. le Cat was perpetual secretary. After the publication of this treatise, he became, in 1760, member of the Royal Academy of Sciences of Berlin; in 1761, of the Imperial Academy of Naturalists; and, in 1762, of the Imperial Academy of Sciences at St Petersburg. In order to enable such as might be desirous of following him in his intricate and most astonishing discoveries respecting the structure of this animal, Mr Lyonet published, in the 'Transactions of the Dutch Society of Sciences at Haerlem,' a description and a plate (as he also afterwards did in French at the beginning of his *Traité Anatomique*) of the instrument and tools he had invented for the purpose of dissection, and likewise of the method he used to ascertain the degree of strength of his magnifying glasses. Notwithstanding all this labour, which was considerably increased by the extensive correspondence which he for many years carried on with several learned and respectable personages, he still found means to

set apart a large proportion of his time (as he himself mentions it in his preface) for the immediate service of his country; but was not fortunate enough (as appears by his writings) to get any other recompense for his exertions than sorrow and disappointment.—During the last fifteen or twenty years of his life, Mr Lyonet added to the valuable treasure he had already collected of natural curiosities, a most superb cabinet of paintings, consisting of more than 560 performances; among which are many of the most eminent works of the first Dutch masters. He did this with a view to procure himself some amusement during the latter part of his life, when old age and infirmities must weaken his powers, and set bounds to his activity. He had always indeed accustomed himself to employment, in so much that he has written some pieces of Dutch poetry; and this disposition remained with him till within a fortnight of his death, when he was attacked with an inflammation in his breast, which, though apparently cured, was, in the end, the cause of his dissolution. He died at the Hague in January 1789, aged 83 years, leaving behind him a most estimable character.

LYONNOIS, a large province of France; bounded on the north by Burgundy; on the east, by Dauphiny, Bresse, and the principality of Dombes; on the south, by Vivarais and Velay; and on the west, by Auvergne and a small part of Bourbonnais. It comprehends Lower Lyonnais, Beaujolais, and Forez; and it produces corn, wine, fruits, and more especially excellent chefnuts. The principal rivers are the Soane, the Rhone, and the Loire. Lyons is the capital town.

LYONS, a large, rich, handsome, ancient, and famous town of France, being the most considerable in the kingdom, next to Paris, with an archbishop's see, an academy of sciences and belles lettres, and an academy of arts and sciences settled here in 1736. It is seated in the centre of Europe, on the confluence of the rivers Rhone and Soan: on the side of it are two high mountains; and the mountain of St Sebastian serves as a bulwark against the north winds, which often blow here with great violence. It contains about 150,000 inhabitants; and the houses, in general, are high, and well built. It has six gates, and as many suburbs. The town-house, the arsenal, the amphitheatre built by the ancient Romans, the hospital, and the numerous palaces, are worthy of a traveller's attention. The cathedral is a superb structure, and the canons that compose the chapter are all persons of distinction. It is a place of very great trade, which is extended not only through France, but to Italy, Switzerland, and Spain; and there are four celebrated fairs every year, which are frequented by great numbers of people. It derives vast advantages from the rivers it stands upon; and is situated in E. Long. 4. 55. N. Lat. 45. 46.

LYRA, in ichthyology. See CALYONIMUS.

LYRA, in astronomy, a constellation in the northern hemisphere. The number of its stars, in Ptolemy's catalogue, is ten; in Tycho's eleven; in Hevelius's seventeen; and in the Britannic catalogue twenty-one.

LYRE, a musical instrument of the stringed kind, much used by the ancients.

Concerning the number of strings with which this instrument was furnished, there is great controversy. Some assert it to be only three; and that the founds of the two remote were acute, and that of the intermediate one a mean between those two extremes: that Mercury, the inventor, resembled those three chords to as many seasons of the year, which were all that the Greeks reckoned, namely, Summer, Winter, and Spring: assigning the acute to the first, the grave to the second, and the mean to the third.

Others assert that the lyre had four strings; that the interval between the first and the fourth was an octave; that the second was a fourth from the first, and the fourth the same distance from the third, and that from the second to the third was a tone.

Another class of writers contend that the lyre of Mercury had seven strings. Nicomachus, a follower of Pythagoras, and the chief of them, gives the following account of the matter: "The lyre made of the shell was invented by Mercury; and the knowledge of it, as it was constructed by him of seven strings, was transmitted to Orpheus: Orpheus taught the use of it to Thamyris and Linus; the latter of whom taught it to Hercules, who communicated it to Amphion the Theban, who built the seven gates of Thebes to the seven strings of the lyre." The same author proceeds to relate, "That Orpheus was afterwards killed by the Thracian women; and that they are reported to have cast his lyre into the sea, which was afterwards thrown up at Antissa, a city of Lesbos: that certain fishers finding it, they brought it to Terperand, who carried it to Egypt, exquisitely improved, and, showing it to the Egyptian priests, assumed to himself the honour of its invention."

This difference among authors seems to have arisen from their confounding together the Egyptian and the Grecian Mercuries.—The invention of the primitive lyre with three strings was due to the first Egyptian HERMES, as mentioned under that article.—The lyre attributed to the Grecian Mercury is described by almost all the poets to be an instrument of seven strings†. + See Memoirs of Galilei has collected the various opinions of early. the several Greek writers who have mentioned the invention of the chelys or testudo; and the late Mr Spence has done the same in a very circumstantial but ludicrous manner. "Horace talks of Mercury as a wonderful musician, and represents him with a lyre. There is a ridiculous old legend relating to this invention, which informs us, that Mercury, after stealing some bulls from Apollo, retired to a secret grotto, which he used to frequent, at the foot of a mountain in Arcadia. Just as he was going in, he found a tortoise feeding at the entrance of his cave: he killed the poor creature, and, perhaps, eat the flesh of it. As he was diverting himself with the shell, he was mightily pleased with the noise it gave from its concave figure. He had possibly been cunning enough to find out, that a thong pulled strait and fastened at each end, when struck by the finger, made a sort of musical sound. However that was, he went immediately to work, and cut several thongs out of the hides he had lately stolen, and fastened them as tight as he could to the shell of this tortoise; and, in playing with them, made a new kind of music with them to divert himself in his retreat."

retreat." This, considered only as an account of the first invention of the lyre, is not altogether so unnatural.

The most ancient representations of this instrument agree very well with the account of its invention: the lyre, in particular on the old celestial globes, was represented as made of one entire shell of a tortoise; and that Amphion in the celebrated group of the Dirce or Toro, in the Farnese palace at Rome, which is of Greek sculpture, and very high antiquity, is figured in the same manner.

There have, however, been many other claimants to the seven-stringed lyre. For though Mercury invented this instrument in the manner already related, it is said he afterwards gave it to Apollo, who was the first that played upon it with method, and made it the constant companion of poetry. According to Homer's account of this transaction, in his hymn to Mercury, it was given by that god to Apollo, as a peace-offering and indemnification for the oxen which he had stolen from him:

To Phœbus Maia's son presents the lyre,
A gift intended to appease his ire.
The god receives it gladly, and essays
The novel instrument a thousand ways;
With dextrous skill the plectrum wilds; and sings,
With voice accordant to the trembling strings,
Such strains as gods and men approv'd, from whence
The sweet alliance sprung of sound and sense.

Diodorus informs us, that Apollo soon repenting of the cruelty with which he had treated Marsyas in consequence of their musical contest, broke the strings of the lyre, and by that means put a stop for a time to any further progress in the practice of that new instrument. "The muses (adds he) afterwards added to this instrument the string called *mesé*; Linus, that of *lichanos*; and Orpheus and Thamyris, those strings which are named *hypate* and *parhypate* (A).

Again, many ancient and respectable authors tell us, that, before the time of Terpander, the Grecian lyre had only four strings; and, if we may believe Suidas, it remained in this state 836 years, from the time of Amphion, till Terpander added to it three new strings, which extended the musical scale to a heptachord, or seventh, and supplied the player with two conjoint tetrachords. It was about 150 years after this period, that Pythagoras is said to have added an eighth string to the lyre, in order to complete the octave, which consisted of two disjoint tetrachords.

Boethius gives a different history of the scale, and tells us, that the system did not long remain in such narrow limits as a tetrachord. Chiorsebus, the son of Athis, or Atys, king of Lydia, added a fifth string; Hyagnis, a sixth; Terpander, a seventh; and, at length, Lychaon of Samos, an eighth. But all these accounts are irreconcilable with Homer's hymn to Mercury, where the chelys, or testudo, the invention of which he ascribes to that god, is said to have had seven strings. There are many claimants among the musicians of ancient Greece to the strings that were afterwards added to these, by which the scale, in the time of Aristoxenus, was extended to two octaves. Athenæus, more than once, speaks of the nine-stringed instrument; and Ion of Chios, a tragic and lyric poet and philosopher, who first recited his pieces in the 82d olympiad, 452 B.C. mentions, in some verses quoted by Euclid, the ten-stringed lyre; a proof that the third conjoint tetrachord was added to the scale in his time, which was about 50 years after Pythagoras is supposed to have constructed the octachord.

The different claimants among the Greeks to the same musical discoveries, only prove, that music was cultivated in different countries; and that the inhabitants of each country invented and improved their own instruments, some of which happening to resemble those of other parts of Greece, rendered it difficult for historians to avoid attributing the same invention to different persons. Thus the single flute was given to Minerva and to Marsyas; the syrinx or fistula, to Pan and to Cybele; and the lyre or chithara, to Mercury, Apollo, Amphion, Linus, and Orpheus. Indeed, the mere addition of a string or two to an instrument without a neck, was so obvious and easy, that it is scarce possible not to conceive many people to have done it at the same time.

With respect to the form of the ancient lyre, as little agreement is to be found among authors as about the number of strings. The best evidences concerning it are the representations of that instrument in the hands of ancient statues, bas-reliefs, &c. See *Plat.* CCLXXXV. where,

Fig. 1. is a representation of the testudo, or lyre of Amphion, in front, as it appears on the base of the celebrated Toro Farnese at Rome. This admirable work, consisting of four figures bigger than the life, besides the toro, or bull, was found in Caracalla's baths, where the Farnese Hercules was likewise discovered: and, except

(A) It has been already related, that the lyre invented by the Egyptian Mercury had but three strings; and by putting these two circumstances together, Dr Burney observes, we may perhaps acquire some knowledge of the progress of music, or, at least, of the extension of its scale, in the highest antiquity.

Mesé, in the Greek music, is the fourth sound of the second tetrachord of the great system, and first tetrachord invented by the ancients, answering to our A, on the fifth line in the base. If this sound then was added to the former three, it proves two important points: first, that the most ancient tetrachord was that from E in the base to A; and that the three original strings in the Mercurian and Apollonian lyre were tuned E, F, G, which the Greeks called *Hypate Meson*, *Parhypate Meson*, *Meson Diatonos*. The addition therefore of *Mesé* to these, completed the first and most ancient tetrachord, E, F, G, A.

The string *lichanos*, then, being added to these, and answering to our D on the third line in the base, extended the compass downwards, and gave the ancient lyre a regular series of five sounds in the Dorian mode, the most ancient of all the Greek modes; and the two strings called *Hypate* and *Parhypate*, corresponding with our B and C in the base, completed the heptachord, or seven sounds, B, C, D, E, F, G, A, a compass that received no addition till after the time of Pindar, who calls the instrument then in use the *seven-tongued lyre*.

Lyre.

cept the Laocoon, is the only piece of Greek sculpture mentioned by Pliny that is now remaining. The two projections near the bottom seem to have been fastenings for the strings, and to have answered the purpose of tail-pieces in modern instruments.

2. The lyre held by Terpsichore, in the picture of that muse dug out of Herculaneum.

3. The Abyssinian telludo, or lyre in use at present in the province of Tigre, from a drawing of Mr Bruce, communicated to Dr Burney. "This instrument (says he) has sometimes five, sometimes six, but most frequently seven strings, made of the thongs of raw sheep or goat skins, cut extremely fine, and twisted; they rot soon, are very subject to break in dry weather, and have scarce any found in wet. From the idea, however, of this instrument being to accompany and sustain a voice, one would think that it was better mounted formerly. "The Abyssinians have a tradition, that the sistrum, tyre, and tambourine, were brought from Egypt into Ethiopia, by Thot, in the very first ages of the world. The flute, kettle-drum, and trumpet, they say, were brought from Palestine, with Menes, the son of their queen of Saba by Solomon, who was their first Jewish king.

"The lyre in Amharic is called *beg*, 'the sheep;' in Ethiopic, it is called *mesinko*; the verb *sinko* signifies to strike strings with the fingers: no plectrum is ever used in Abyssinia; so that *mesinko*, being literally interpreted, will signify the 'stringed instrument played upon with the fingers.'

"The sides which constitute the frame of the lyre were anciently composed of the horns of an animal of the goat kind called *agazam*, about the size of a small cow, and common in the province of Tigre. I have seen several of these instruments very elegantly made of such horns, which nature seems to have shaped on purpose. Some of the horns of an African species of this animal may be seen in M. Buffon's history of the king of France's cabinet. They are bent, and less regular than the Abyssinian; but after fire-arms became common in the province of Tigre, and the woods were cut down, this animal being more scarce, the lyre has been made of a tight red wood; however, it is always cut into a spiral twisted form, in imitation of the ancient materials of which the lyre was composed. The drawing I send you was one of these instruments made of wood.

"The kingdom of Tigre, which is the largest and most populous province of Abyssinia, and was during many ages the seat of the court, was the first which received letters and civil and religious government; it extended once to the Red Sea: various reasons and revolutions have obliged the inhabitants to resign their sea-coast to different barbarous nations, Pagan and Mahometan: while they were in possession of it, they say that the Red Sea furnished them with tortoise-shells, of which they made the bellies of their lyres, as the Egyptians did formerly, according to Apollodorus and Lucian; but having now lost that resource, they have adopted, in its place, a particular species of gourd, or pumpkin, very hard and thin in the bark, still imitating with the knife the foursquares, compartments, and figure of the shell of the tortoise.

"The lyre is generally from three feet to three feet six inches high; that is, from a line drawn thro' the point of the horns, to the lower part of the base of

the sounding board. It is exceedingly light, and easy of carriage, as an instrument should naturally be in so rugged and mountainous a country.

"When we consider the parts which compose this lyre, we cannot deny it the earliest antiquity. Man in his first state was a hunter and a fisher, and the oldest instrument was that which partakes most of that state. The lyre, composed of two principal pieces, owes the one to the horns of an animal, the other to the shell of a fish.

"It is probable, that the lyre continued with the Ethiopians in this rude state as long as they confined themselves to their rainy, steep, and rugged mountains: and afterwards, when many of them descended along the Nile in Egypt, its portability would recommend it in the extreme heats and weariness of their way. Upon their arrival in Egypt, they took up their habitation in caves, in the sides of mountains, which are inhabited to this day. Even in these circumstances, an instrument larger than the lyre must have been inconvenient and liable to accidents in those caverns; but when these people increased in numbers and courage, they ventured down into the plain, and built Thebes. Being now at their ease, and in a fine climate, all nature smiling around them, music and other arts were cultivated and refined, and the imperfect lyre was extended into an instrument of double its compass and volume. The size of the harp could be now no longer an objection; the Nile carried the inhabitants every where easily, and without effort; and we may naturally suppose in the fine evenings of that country, that the Nile was the favourite scene upon which this instrument was practised; at least the sphinx and lotus upon its head, seem to hint that it was somehow connected with the overflowings of that river." See HARR.

4. An Etruscan lyre, with seven strings, in the collection of Etruscan, Greek, and Roman antiquities, published from the cabinet of the Hon. Sir William Hamilton, Vol. I. Naples 1766. Pl. cix. With respect to this instrument, it is worthy of observation, that though the vase upon which it is represented is of such indisputable and remote antiquity, the tail-piece, bridge, belly, and sound-holes, have a very modern appearance, and manifest a knowledge in the construction of musical instruments among the Etruscans superior to that of the Greeks and Romans in much later times. The lower part of the instrument has much the appearance of an old bass-viol, and it is not difficult to discover in it more than the embryo of the whole violin family. The strings lie round, as if intended to be played on with a bow; and even the cross lines on the tail-piece are such as we frequently see on the tail-pieces of old viols.

5. The Tripodian lyre of Pythagoras the Zacynthian, from a bas-relief in the Massic palace at Rome representing the whole choir of the muses. Athenæus gives the following account of this extraordinary instrument, *lib. xiv. cap. 15. p. 637*. "Many ancient instruments are recorded (says Artemon), of which we have so little knowledge, that we can hardly be certain of their existence; such as the tripod of Pythagoras the Zacynthian, which, on account of its difficulty, continued in use but a short time. It resembled in form the Delphic tripod, whence it had its name. The legs were equidistant, and fixed upon

Lyre.

Lyric

Lyrias,

upon a moveable base that was turned by the foot of the player; the strings were placed between the legs of the stool; the vase at the top served for the purpose of a sound-board, and the strings of the three sides of the instrument were tuned to three different modes, the Doric, Lydian, and Phrygian. The performer sat on a chair made on purpose; striking the strings with the fingers of the left hand, and using the plectrum with the right, at the same time turning the instrument with his foot to whichever of the three modes he pleased: so that by great practice he was enabled to change the modes with such velocity, that those who did not see him would imagine they heard three different performers playing in three different modes. After the death of this admirable musician, no other instrument of the same kind was ever constructed."

6. A lyre in the famous ancient picture dug out of Herculaneum, upon which Chiron is teaching the young Achilles to play. See CHIRON.

LYRIC-POETRY, was such as the ancients sung to the lyre or harp.—It was originally employed in celebrating the praises of gods and heroes, and its characteristic was sweetness. Who was the author of it is not known. It was much cultivated by the Greeks; and Horace was the first who attempted it in the Latin language. Anacreon, Alcæus, Stesichorus, Sappho, and Horace, were the most celebrated lyric poets of antiquity.

LYRODI, among the ancients, a kind of musicians who played on the lyre and sung at the same time. This appellation was also given to such as made it their employment to sing lyric poems composed by others.

LYS, or LIS. See LIS.

LYS, the name of a measure used by the Chinese in estimating distances. Two hundred lys make 60 geographical miles, which are equal to one degree.

LYSANDER, a famous Spartan general. See SPARTA.

LYSANDRIA, a Samian festival, celebrated with games and sacrifices in honour of the Lacedæmonian general Lysander. It was anciently called *berea*; but this name the Samians abolished by a public decree.

LYSIARCH, an ancient magistrate, who superintended the sacred games, and presided in matters of religion in the province of Lycia. He was created in a council consisting of deputies from all the provincial cities, in number 23. The lysiarchs were both heads of the council and pontiffs of the province.

LYSIAS, an ancient Grecian orator, was born at Syracuse in the 80th olympiad. At 15, he went to Thurion, a colony of the Athenians; and when grown up, assisted in the administration of the government there many years. When about 47 years of age, he returned to Athens; whence, being afterwards banished by the 30 tyrants, he went to Megara. Upon his return, Thrasylbus would have had him employed again in state matters; but this not taking place, he spent the remainder of his life as a private man. He was very familiar with Socrates, and other illustrious philosophers. He professed to teach the art of speaking; not that he pleaded at the bar

himself, but he supplied others with speeches. "Fuit Lysimachia Lyrias in causis forensibus non veritatus" (says Cicero), sed egregie subtilis scriptor atque elegans," &c. Quintilian calls him, "subtilis atque elegans, et quo nihil, si Oratorio satis sit docere, quæras perfectius. Nihil enim est inane, nihil arcebitum; puro tamen fonti, quam magno flumini, proprius." Plutarch and Phœtius relate, that 425 orations were formerly exhibited under the name of Lyrias; of which 34 only are now extant. The best edition of them is by Dr John Taylor at London, 1739, 4to; Cambridge, 1740, 8vo.

LYSIMACHIA, LOOSESTRIPE, in botany. A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 20th order, *Rotaceæ*. The corolla is rotaceous; the capsule globular, beaked, and tenvalved. There are ten species, but only four are commonly cultivated in gardens. These are hardy, herbaceous perennials and biennials, rising with erect stalks from 18 inches to two or three feet high; garnished with narrow entire leaves; and terminated by spikes and clusters of monopetalous, rotated, five-parted spreading flowers of white and yellow colours.—They are easily propagated by seeds, and will thrive in any soil or situation.

LYSIPPUS, a celebrated Greek statuary, was born at Sicyone, and at first followed the business of a locksmith, which he quitted in order to practise painting: But he afterwards applied himself entirely to sculpture; in which he acquired an immortal reputation, and made a great number of statues that were the admiration of the people of Athens and Rome. His grand statue of the sun represented in a car drawn by four horses, was worshipped at Rhodes; he made several statues of Alexander and his favourites, which were brought to Rome by Metellus after he had reduced the Macedonian empire; and the statue of a man wiping and anointing himself after bathing, being particularly excellent, was placed by Agrippa before his baths in that city. He lived in the time of Alexander the Great, about 334 B. C.; and left three sons, who were all famous artists.

LYTHRUM, PURPLE LOOSESTRIPE, in botany. A genus of the monogynia order, belonging to the decandria class of plants; and in the natural method ranking under the 17th order, *Calycanthemæ*. The calyx is cleft in 12 parts; and there are six petals inserted into it; the capsule is bilocular and polypermous. There are 10 species, of which the most remarkable are, 1. The faliçaria, or common purple loosestrife, with oblong leaves, is a native of Britain, and grows naturally by the sides of ditches and rivers. It hath a perennial root, from which come forth several upright angular stalks, rising from three to four feet high, garnished with oblong leaves placed sometimes by pairs; but sometimes there are three leaves at each joint standing round the stalk. The flowers are purple, and produced in a long spike at the top of the stalk; so make a fine appearance. 2. The hyspanum, or Spanish loosestrife, with an hyssop leaf, grows naturally in Spain and Portugal. It hath a perennial root. The stalks are slender, not more than nine or ten inches long, spreading out on every side. The lower part of the stalks is garnished

Lytelton. with oblong oval leaves placed opposite. The flowers come out singly from the side of the stalks at each joint; they are larger than those of the common fort, and make a fine appearance in the month of July when they are in beauty. The first kind is propagated by parting the roots in autumn, but requires a moist soil;—the second is propagated by seeds brought from those countries where it is native.

LYTTELTON (Edward), lord Lyttelton, keeper of the great seal in the reign of Charles I. was eminent for his probity and his moderation at the commencement of that monarch's disputes with his subjects. Without forfeiting his fidelity to the king, he preserved the esteem of the parliament till 1644, when he was made colonel of a regiment in the king's army at York. He died in 1645. Besides several of his speeches which have been printed, he wrote reports in the common pleas and exchequer printed at London in 1683, in folio; several arguments and discourses, &c.

LYTTELTON (George lord) eldest son of Sir Thomas Lyttelton, bart. descended from the great judge Lytton, was born in 1700, at seven months; and the midwife supposing him to be dead, threw him carelessly into the cradle; where, had not some signs of life been taken notice of by one of the attendants, he might never have recovered. He received the elements of his education at Eaton-school, where he showed an early inclination to poetry. His pastorals and some other light pieces were originally written in that seminary of learning; from whence he was removed to the university of Oxford, where he pursued his classical studies with uncommon avidity, and sketched the plan of his Persian Letters, a work which afterwards procured him great reputation, not only from the elegance of the language in which they were composed, but from the excellent observations they contained on the manners of mankind.

In the year 1728, he set out on the tour of Europe; and, on his arrival at Paris, accidentally became acquainted with the honourable Mr Poyntz, then our minister at the court of Versailles; who was so struck with the extraordinary capacity of our young traveller, that he invited him to his house, and employed him in many political negotiations, which he executed with great judgment and fidelity.

Mr Lyttelton's conduct, while on his travels, was a lesson of instruction to the rest of his countrymen. Instead of lounging away his hours at the coffee-houses frequented by the English, and adopting the fashionable follies and vices of France and Italy, his time was passed alternately in his library and in the society of men of rank and literature. In this early part of his life, he wrote a poetical epistle to Dr Ayscough, and another to Mr Pope, which show singular taste and correctness.

After continuing a considerable time at Paris with Mr Poyntz, who, to use his own words, behaved like a second father to him, he proceeded to Lyons and Geneva; and from thence to Turin, where he was honoured with great marks of friendship by his Sardinian majesty. He then visited Milan, Venice, Genoa, and Rome, where he applied himself closely to the study of the fine arts; and was, even in that celebrated

metropolis, allowed a perfect judge of painting, sculpture, and architecture.

During his continuance abroad, he constantly corresponded with Sir Thomas, his father. Several of his letters are yet remaining, and place his filial affection in a very distinguished light. He soon after returned to his native country, and was elected representative for the borough of Okehampton in Devonshire; and behaved so much to the satisfaction of his constituents, that they several times re-elected him for the same place without putting him to the least expence.

About this period, he received great marks of friendship from Frederic prince of Wales, father of his present majesty; and was, in the year 1737, appointed principal secretary to his royal highness, and continued in the strictest intimacy with him till the time of his death. His attention to public business did not, however, prevent him from exercising his poetical talent. A most amiable young lady, Miss Fortescue, inspired him with a passion, which produced a number of little pieces, remarkable for their tenderness and elegance; and he had a happy facility of striking out an extempore compliment, which obtained him no small share of reputation. One evening being in company with lord Cobham and several of the nobility at Stowe, his lordship mentioned his design of putting up a bust of lady Suffolk in his beautiful gardens; and, turning to Mr Lyttelton, said, "George, you must furnish me with a motto for it." "I will, my lord," answered Mr Lyttelton; and directly produced the following couplet:

Her wit and beauty for a court were made,
But truth and goodness fit her for a shade.

When Mr Pitt, the late earl of Chatham, lost his commission in the guards, in consequence of his spirited behaviour in parliament, Mr Lyttelton was in waiting at Leicester-house, and, on hearing the circumstance, immediately wrote these lines:

Long had thy virtue mark'd thee out for fame,
Far, far superior to a cornet's name;
This generous Walpole saw, and griev'd to find
So mean a post disgrace that noble mind;
The servile standard from thy free-born hand
He took, and bade thee lead the patriot-band.

In the year 1742, he married Lucy, the daughter of Hugh Fortescue, Esq; of Filleigh in the county of Devon, the lady abovementioned, whose exemplary conduct, and uniform practice of religion and virtue, established his conjugal happiness upon the most solid basis.

In 1744, he was appointed one of the lords commissioners of the treasury; and, during his continuance in that station, constantly exerted his influence in rewarding merit and ability. He was the friend and patron of the late Henry Fielding, James Thomson, author of the Seasons, Mr Mallet, Dr Young, Mr Hammond, Mr West, Mr Pope, and Voltaire. On the death of Thomson, who left his affairs in a very embarrassed condition, Mr Lyttelton took that poet's sister under his protection. He revised the tragedy of Coriolanus, which that writer had not put the last

Lyttelton. hand to; and brought it out at the theatre-royal, Covent-garden, with a prologue of his own writing, in which he so affectingly lamented the loss of that delightful bard, that not only Mr Quin, who spoke the lines, but almost the whole audience, spontaneously burst into tears.

In the beginning of the year 1746, his felicity was interrupted by the loss of his wife, who died in the 29th year of her age; leaving him one son, Thomas, the late lord Lyttelton; and a daughter, Lucy, who some time since married lord viscount Valentia. The remains of his amiable lady were deposited at Over-Arley in Worcester-shire; and an elegant monument was erected to her memory in the church of Hagley, which contains the following inscription written by her husband:

Made to engage all hearts, and charm all eyes:
Tho' meek, magnanimous; tho' witty, wife;
Polite, as all her life in courts had been;
Yet good, as the world had never seen:
The noble fire of an exalted mind,
With gentlest female tenderness combin'd.
Her speech was the melodious voice of love,
Her song the warbling of the vernal grove;
Her eloquence was sweeter than her song,
Soft as her heart, and as her reason strong.
Her form each beauty of her mind express'd,
Her mind was virtue by the graces dress'd.

Besides these beautiful lines, Mr Lyttelton wrote a monody on the death of his lady, which will be remembered while conjugal affection and a taste for poetry exist in this country.

His masterly observations on the conversion and apostleship of St Paul, were written at the desire of ap Gilbert West, Esq; in consequence of Mr Lyttelton's asserting, that, beside all the proofs of the Christian religion, which might be drawn from the prophecies of the Old Testament, from the necessary connection it has with the whole system of the Jewish religion, from the miracles of Christ, and from the evidence given of his resurrection by all the other apostles, he thought the conversion of St Paul alone,

duly considered, was of itself a demonstration sufficient to prove Christianity to be a divine revelation. Mr West was struck with the thought; and assured his friend, that so compendious a proof would be of great use to convince those unbelievers that will not attend to a longer series of arguments; and time has shown he was not out in his conjecture, as the tract is esteemed one of the best defences of Christianity which has hitherto been published.

In 1754, he resigned his office of lord of the treasury, and was made cofferer to his majesty's household, and sworn of the privy-council: previous to which, he married, a second time, Elizabeth, daughter of field-marshal Sir Robert Rich, whose indiscreet conduct gave him great uneasiness, and from whom he was separated by mutual consent, a few years after his marriage.

After being appointed chancellor and under-treasurer of the court of exchequer, he was, by letters-patent dated the 10th of November 1757; 31 Geo. II. created a peer of Great Britain, by the style and title of *Lord Lyttelton, baron of Frankley, in the county of Worcester*. His speeches on the Scotch and mutiny bills in the year 1747, on the Jew bill in 1753, and on the privilege of parliament in 1763, showed sound judgment, powerful eloquence, and inflexible integrity. During the last ten years he lived chiefly in retirement, in the continual exercise of all the virtues which can ennoble private life. His last work was *Dialogues of the Dead*, in which the morality of Cambray and the spirit of Fontenelle are happily united.

He was suddenly seized with an inflammation of the bowels, in the middle of July 1773, at his seat at Hagley; which terminated in his death, on the 22d of that month. His last moments were attended with unimpaired understanding, unaffected greatness of mind, calm resignation, and humble but confident hopes in the mercy of God. As he had lived universally esteemed, he died lamented by all parties. A complete collection of his works has been published since his decease, by his nephew George Asycough, Esq.

M.

M, a liquid consonant, and the twelfth letter in the alphabet.

It has one unvaried sound, and is pronounced by striking the upper lip against the lower; in which the pronunciation of this letter agrees with that of *b*; the only difference between the two consisting in a little motion made in the nose in pronouncing *m*, and not in *b*: whence it happens that those who have taken cold, for *m* ordinarily pronounce *b*; the nose in that case being disabled from making the necessary motion.

All consonants are formed with the aid of vowels;

in *em* the vowel precedes, in *be* it follows; and *m* is never mute.

Quintilian observes, that the *m* sometimes ends Latin words, but never Greek ones; the Greeks always changing it in that case into *n*, for the sake of the better sound.

M is also a numeral letter, and among the ancients was used for a thousand; according to the verse,

M caput est numeri, quem scimus mille teneri.

When a dash is added to the top of it, as *m̄*, it signifies a thousand times a thousand.

Maat
||
Macao.

M, as an abbreviation, stands for Manlius, Marcus, Martius, and Mucius: M. A. signifies *magister artium*, or master of arts; MS. manuscript, and MSS. manuscripts.

M, in astronomical tables, and other things of that kind, is used for *meridional* or southern; and sometimes for *meridian* or mid-day.

M, in medicinal prescription, is frequently used to signify a maniple or handful: and it is sometimes also put at the end of a recipe, for *mise* "mingle;" or for *mistura* "a mixture." Thus, *m. f. julapium*, signifies "mix and make a julep."

M, in law, the brand or stigma of a person convicted of manslaughter, and admitted to the benefit of his clergy. It is to be burnt on the brawn of his left thumb.

MAAT (John). See BLANKOF.

MABA, in botany: A genus of the triandria order, belonging to the diœcia class of plants. The perianthium of the male is trisid; that of the female is as in the male; the fruit is a plum two-celled superior.

MABILLON (John), a very learned writer of France in the 17th century, was born at Perre-monte, on the frontiers of Champagne, in 1632. He was educated in the university of Rheims, and afterwards entered into the abbey of the Benedictines of St Remy. In the year 1663, he was appointed keeper of the treasures and monuments of France at St Dennis: but having unfortunately broke a looking-glass there, which was pretended to have belonged to Virgil, he desired leave of his superiors to quit an employment which frequently obliged him to tell things he did not believe. Next year he went to Paris; and was very servicable to Father d'Acheri, who was desirous of having some young monk who could assist him in compiling his *Spicilegium*. This made him known. Soon after, the congregation of St Maur having formed a design of publishing new editions of the fathers, revived from the MSS. in the libraries of the Benedictines, Mabillon was charged with the edition of St Bernard, which he prepared with extraordinary diligence. After that, he published many other works, which are evidences of his vast capacity and industry. In 1682, he was employed by Mr Colbert in examining some ancient titles relating to the royal family. The year following he sent him into Germany, to search the archives and libraries of the ancient abbays, for what was most curious and proper to illustrate the history of the church in general, and that of France in particular. He has published an account of this journey. In 1685, he undertook another journey into Italy, by order of the king of France; and returned the year following with a very noble collection. He placed in the king's library above 3000 volumes of rare books, printed and in MSS. and composed two volumes of the pieces which he had discovered in that country. He was highly esteemed for his virtues as well as his learning.

MACACO, or MACAUO. See LEMUR.

MACAO, a town of China, in the province of Canton, seated in an island at the mouth of the river Tae. The Portuguese have been in possession of the harbour for 150 years. Formerly they had a great trade here; but now they have only a fort with a small

garrison. The houses are built after the European manner; and there is a Chinese mandarin, as well as a Portuguese governor, to take care of the town and the neighbouring country. E. Long. 112. 13. N. Lat. 22. 12.

MACAO, in ornithology. See PSITTACUS.

MACARIANS, in ecclesiastical history, the followers of Macarius, an Egyptian monk, who was distinguished towards the close of the fourth century for his sanctity and virtue. In his writings there are some superstitious tenets, and also certain opinions that seem tainted with Origenism. The name has been also applied to those who adopted the sentiments of Macarius a native of Ireland, who, about the close of the ninth century, propagated in France the error afterwards maintained by Averrhoes, that one individual intelligence or soul performed the spiritual and rational functions in all the human race.

MACARONI. See FOLENGIO, and the next article.

MACARONIC, or MACARONIAN, a kind of burlesque poetry, consisting of a jumble of words of different languages, with words of the vulgar tongue Latinized, and Latin words modernized. *Macaroni* among the Italians, as has been observed by Celius Rhodiginus, signifies a *coarse clownish man*; and because this kind of poetry is patched out of several languages, and full of extravagant words, &c. the Italians, among whom it had its rise, gave it the name of *macaronian*, or *macaronic* poetry. Others choose to derive it à *macaronibus*, from *macaroons*, a kind of confection made of meal not bolted, sweet-almonds, sugar, and the white of eggs, accounted a great dainty among the country-people in Italy; which, from their being composed of various ingredients, occasioned this kind of poetry, which consists of Latin, Italian, Spanish, French, English, &c. to be called by their name.

Example.—A bold fellow in the *macaronic* style, says,

Enflavi omnes scadrones & regimandos, &c.

Another example:

*Archelos pifoliferos furiâque manantem,
Et grandem efmeutam qua inopinum facta ruelle est:
Tosinunque alto troublantem corda clobero, &c.*

Theoph. Folengius, a Benedictine monk of Mantua, was the first who invented, or at least cultivated, this kind of verse. See FOLENGIO.

The best pieces of this kind are, the *Baldus* of Folengio, and *Macaronis Forza* by Stefonio a Jesuit, among the Italians; and the *Reatus veritabilis super terribili efmeuta passanarum de Ruellis*, among the French. The famous Rabelais first transferred the *macaronic* style out of the Italian verse into French prose: and on the model thereof formed some of the best things in his *Pantagruel*. We have little in English in the *macaronian* way; nothing scarce, but some little loose pieces collected in Camden's remains. But the Germans and Netherlands have had their *macaronic* poets; witness the *Certainen Catholicum cum Catechismus*, of one Martinus Hamconius Frisius, which contains about 1200 verses, all the words whereof begin with the letter C.

MACARSKA,

Macao
||
Macaronic.

Macarska
||
Maccabees

MACARSKA, a town of Dalmatia, and capital of Primorgia, with a pretty good harbour, and a bishop's see, seated on the gulph of Venice. E. Lon. 17. 57. N. Lat. 43. 42.

MACASSAR, a considerable kingdom of the island of Celebes, in the East-Indies. The climate is very hot; and would be intolerable, were it not for the rains which fall when the sun is directly over their heads. The soil is extremely fertile, and there are ripe fruits at all times of the year. There are great numbers of monkeys, who are devoured by monstrous serpents; some of which are so large, that they will swallow one of these animals entire. The Macassars are large, robust, courageous, and greatly addicted to war. They profess the Mahometan religion.

MACASSAR, a large, strong, and handsome town of the island of Celebes, and capital of the kingdom of the island of Celebes, where the king resides. The houses are all built of wood, and supported by thick posts; and they have ladders to go up into them, which they draw up as soon as they have entered. The roofs are covered with very large leaves, which prevent the rain from entering. It is seated near the mouth of a large river, which runs through the kingdom from north to south. E. Long. 117. 55. S. Lat. 5. 0.

MACASSAR Poison, in natural history, called *ippo* in the Macassar and Malayan tongue, is the gum of a certain tree, shining, brittle, black, and every way like stone-pitch, growing in the island Celebes, in the South Seas; with which all the natives arm themselves in travel, having a long hollow trunk of a hard red wood like brass, accurately bored, and at one end is fixed a large lance-blade of iron. Then they make a small arrow, very straight, and somewhat bigger than a large wheaten straw: at one end they fix it into a round piece of white, light, soft, wood, like cork, about the length of the little finger, just fit for the bore of the trunk, to pass clear by the force of one's breath, and to fill it so exactly, that the air may not pass by, but against it, in order to carry it with the greater force. At the other end they fix in it either a small fish-tooth for that purpose, or make a blade of wood of the bigness of the point of a lancet, about three-quarters of an inch long, and making a little notch in the end of the arrow, they strike it firm therein, which they anoint with poison. The poisonous gum, when gathered, is put into hollow bamboos or canes, stopped up very close, and thus brought to Macassar. When they fit it for use, they take a piece of smooth turtle-shell, and a stick cut flat and smooth at the end; then they take green galangal root, grate it, and with the addition of a little fair water, press the juice into a clean china dish: then with a knife scraping a little of the poison upon the shell, dip the end of the stick in the forementioned liquor, and with this dissolve the poison to the consistence of a syrup: when this is done, they anoint the fish-tooth or wooden blade with the same stick, and lay it in the sun, so that it may be baked hard. The pointed arrows thus prepared, are put in hollow bamboos, close shut, and in this state they retain their virtue for a month.

MACCABÆUS (Judas). See JUDAS.

MACCABEES, two apocryphal books of scripture,

containing the history of Judas and his brothers, and their wars against the Syrian kings in defence of their religion and liberties, so called from Judas Mattathias, surnamed *Maccabeus*, as some say from the word מַכֵּי, formed of the initials of *מי בכנס לאלים יהיה*, q. d. *Who is like unto thee, O Lord, among the Gods*; which was the motto of his standard; whence those who fought under his standard were called *Maccabees*, and the name was generally applied to all who suffered in the cause of the true religion, under the Egyptian or Syrian kings. The first book of the Maccabees is an excellent history, and comes nearest to the style and manner of the sacred historians of any extant. It was written originally in the Chaldee language, of the Jerusalem dialect, and was extant in this language in the time of Jerom. From the Chaldee it was translated into Greek, from the Greek into Latin. It is supposed to have been written by John Hyrcanus the son of Simon, who was prince and high priest of the Jews near 30 years, and began his government at the time where this history ends. It contains the history of 40 years, from the reign of Antiochus Epiphanes to the death of Simon the high priest; that is, from the year of the world 3829 to the year 3869; 131 years before Christ. The second book of the Maccabees begins with two epistles sent from the Jews of Jerusalem to the Jews of Egypt and Alexandria; to exhort them to observe the feast of the dedication of the new altar erected by Judas on his purifying the temple. The first was written in the 169th year of the era of the Seleucidae, i. e. before Christ 144; and the second in the 188th year of the same era, or 125 before Christ; and both appear to be spurious. After these epistles follows the preface of the author to his history, which is an abridgement of a larger work, composed by one Jason, a Jew of Cyrene, who wrote in Greek the history of Judas Maccabeus and his brethren, and the wars against Antiochus Epiphanes, and Eupator his son. This second book does not by any means equal the accuracy and excellency of the first. It contains a history of about 15 years, from the execution of Heliodorus's commission, who was sent by Seleucus to fetch away the treasures of the temple, to the victory obtained by Judas Maccabeus over Nicanor; that is, from the year of the world 3828, to the year 3843, 147 years before Christ.

There are in the Polyglot bibles, both of Paris and London, Syriac versions of both these books; but they, as well as the English versions which we have among the apocryphal writers in our Bibles, are derived from the Greek. There is also a third book of the Maccabees, containing the history of the persecution of Ptolemy Philopator against the Jews in Egypt, and their sufferings under it; and seems to have been written by some Alexandrian Jew in the Greek language, not long after the time of Siracides. It is in most of the ancient manuscript copies of the Greek Septuagint, particularly in the Alexandrian and Vatican, but was never inserted into the vulgar Latin version of the Bible, nor consequently into any of our English copies. Moreover, Josephus's history of the martyrs that suffered under Antiochus Epiphanes, is found in some manuscript Greek Bibles, under the name of the fourth book of the *Maccabees*.

Macbeth,
Macbride.

MACBETH, a Scots nobleman in the 11th century, nearly allied to Duncan king of Scotland.—Not contented with curbing the king's authority, he carried his pestilent ambition so far as to put him to death; and, chafing Malcolm Kenneth his son and heir into England, usurped the crown. Seward earl of Northumberland, whose daughter Duncan had married, undertook, by the order of Edward the Confessor, the protection of the fugitive prince.—He marched with an army into Scotland; defeated and killed Macbeth; and restored Malcolm to the throne of his ancestors. Shakespeare has made this transaction the subject of one of his best tragedies.

MACBRIDE (Dr David), an eminent physician and philosopher, was descended from an ancient family in the county of Galloway in Scotland. His grandfather, a clergyman, had settled in Ireland about the end of the last century, as minister to a Presbyterian congregation at Belfast; and his father, who followed the same line, was settled at Ballymoney in the county of Antrim, where he married, and where our author was born in April 1726. After a proper school-education, and having passed some time under the tuition of an eminent surgeon in his native place, he was sent to the university of Glasgow. Having there completed the usual course of academical studies, he came to Edinburgh for the further prosecution of medical science. After a short stay here, a war then prevailing between France and Britain, he was induced to go on board the navy in the station of a surgeon's mate. In the service of his country he continued for several years; and after discharging for some time the duties of an assistant, he was raised to the rank of surgeon. In this situation, he first turned his thoughts towards the discovery of a remedy for the sea-scurvy. It was not, however, at this period, that either chance or reasoning suggested to him the employment of an article which has since been attended with the most beneficial consequences. Here he had an opportunity only of observing the symptoms, of studying the nature, and of lamenting the consequences, of the disease.

The termination of the war by the peace of Aix-la-Chapelle put a period to Dr Macbride's employment as a naval surgeon. He had now probably obtained much medical knowledge in the school of experience; but he was sensible that he had still much to acquire in that of science. An ardent keeness to mingle in active life had led him from the schools of medicine at an earlier period than could have been wished; and an earnest desire to found his future practice in the best established principles led him back to them, when a judgment, matured by years, and informed from the observation of facts, rendered him capable of hearing teachers with greater advantage. He returned therefore to Edinburgh, and again entered on the career of academical pursuits, under the tuition of Dr Monro, and those other teachers, whose abilities raised the fame of the medical school at this place. But not satisfied with the instructions to be had from any one set of professors, the celebrity of the medical teachers in London led him also to visit that capital. There he particularly became the pupil of those distinguished lecturers, Dr Hunter and Dr Smellie. And while from the former he laboured to acquire an accurate chirurgical knowledge, from the latter he endeavoured

to obtain the true principles of widelivity considered as a science. At the same time, he was no less industrious in improving himself in the successful practice of both arts by attention at hospitals.

Thus prepared for the exercise of his profession, about the end of the year 1749 he fixed his residence in Dublin in the charactor of surgeon and accoucheur. If amiable manners, and extensive knowledge of his profession, could alone have been sufficient introductions to practice, he might in a short time have looked for a competent share of business in that capital; but while he had to combat that objection which very generally arises from youth, his progress was also not a little retarded by an uncommon degree of modesty. Hence for several years he remained almost in a state of obscurity, and was employed by but few people either of rank or fortune. But, if it is to be regretted that for many years his time was not so fully employed in the lucrative part of his profession as was due to his merit, it ought still to be remembered, that this essentially promoted the cause of science: for by this means his genius and industry were directed to medical researches; and were productive of discoveries which will with honour transmit his name to latest posterity. These, though some of them might have been successfully turned to his own emolument, were freely communicated to the world in different publications; and he did not show greater ingenuity in making discoveries, than liberality of sentiment in publishing them for the advantage of others.—His first publication, intitled, "Experimental Essays on Medical and Philosophical Subjects," made its appearance in the year 1764.—These essays are five in number: 1. On the fermentation of alimentary mixture and the digestion of the food. 2. On the nature and properties of fixed air. 3. On the different kinds of antiseptics. 4. Of the dissolvent power of quicklime. 5. Of the sea-scurvy. The merit of all these is sufficiently known and acknowledged: but the last of them is unquestionably the most important; the method therein proposed of both the prevention and cure of that dreadful disease the scurvy, having been confirmed by repeated and undeniable observation.

Having thus equally distinguished himself as an ingenious philosopher and able practitioner, the world were not now slow in bestowing upon him the tribute of applause to which he was intitled. His name was enrolled with honour in the lists of many learned societies; and the university where his studies had first been commenced, were proud to confer upon him the degree of Doctor of Medicine.

The reputation, however, of being a distinguished author, was to him but a secondary object; and his talents were not confined to the advancement of medicine alone. Having successfully discovered a considerable improvement in the art of tanning, with that spirited generosity which is ever the concomitant of real worth, he speedily and freely communicated it to the public, by publishing, first, "An Account of a New Method of Tanning;" and afterwards, "Instructions for carrying on the New Method of Tanning." As a mark of approbation for this liberal conduct, as well as a testimony of respect for his ingenuity, prize-medals were conferred upon him by the Societies of Arts both in London and Dublin. But his last and most

Macbride.

Macbride most extensive publication was more immediately in the line of his own profession: It is intitled, "A Methodical Introduction to the Theory and Practice of Medicine." In that valuable work he has given a concise and connected view of the principles and practice of the healing art, as best established by sound reason, and confirmed by accurate observation. Most, if not all of these publications, not only went through various editions, but were translated into different languages.

After the merit of Dr Macbride came to be properly known, the public seemed to show a desire of making compensation for having so long overlooked it. His employment increased so rapidly, that he had more business than he could transact either with ease or safety. This having kept him in perpetual agitation both of body and mind, at last induced an almost total incapacity of sleeping. From this circumstance his health could not fail to be impaired. In this situation, after accidental exposure to cold, he was attacked with a fever, which put an end to his life on the 13th of December 1778, in the 53d year of his age.

Those who were his most intimate acquaintance were inclined to believe that his death was not a little hastened by domestic calamities. During his residence in Dublin he was twice married, and was as often subjected to that inexpressible distress which must result from a final separation in this world from the most intimate and loving friends. By both of his wives he had several children; but none of them survived their father. And on these calamitous events, although he was able to conceal his feelings from the world, yet they gave a severe shock to his constitution. After his death, several of the playful trinkets of his infants, with the signature of *dulces exuvia*, were found in his repositories among papers on medical and other important subjects: an incontrovertible proof, that in him at least, the great mind of the philosopher was conjoined with the feeling heart of the affectionate father. But if his abilities were remarkable as a philosopher and physician, if his conduct was exemplary as an husband and parent, his manners were no less amiable as a companion and friend. His polite and benevolent conduct, joined to his taste for the fine arts, conciliated the affections and esteem of all who knew him. His death was universally and sincerely lamented in the city of Dublin.

MACCLESFIELD, a town of Cheshire in England, 171 miles from London, is seated on the edge of a forest of the same name, upon a high bank near the river Bollin; and is a large handsome town, with a fine church and a very high steeple. It was erected into a borough by King Edward III. is governed by a mayor, and enjoys great privileges and jurisdictions by virtue of the court and the liberties of the forest. In its church are two brass plates, on one of which there is a promise of 26,000 years and 26 days pardon for saying five Pater-Nosters and five Aves. Its chief manufacture is mohair buttons. The market is on Mondays; the fairs are June 11 and 30, and Nov. 2. In Macclesfield forest are many pits dug for the sake of the turf; in which it is common to see fir-trees buried, which are dug up for various uses, but chiefly for splinters that serve the poor for candles. W. Long. a 10. N. Lat. 53. 15.

MACE, an ancient weapon, formerly much used by the cavalry of all nations. It was commonly made of iron; its figure much resembles a chocolate-mill; many specimens may be seen in the Tower. It was with one of these that Walworth mayor of London knocked the rebel Wat Tyler from off his horse in Smithfield for approaching the young king Richard II. in an insolent manner; and as he fell, he dispatched him with his dagger. The mace in modern times changed its form; and being no longer a war instrument, is made of copper or silver gilt, ornamented with a crown, globe, and cross, and is now the chief insignia of authority throughout Great Britain. Similar to the ancient maces, were those staves at the end of which iron or leaden balls armed with spikes were suspended by chains: they were till lately carried by the pioneers of the trained-bands or city militia.

MACE, in the materia medica, the second coat or covering of the kernel of the nutmeg, is a thin and membranaceous substance, of an oleaginous nature, and a yellowish colour; being met with in flakes of an inch or more in length, which are divided into a multitude of ramifications. It is of an extremely fragrant, aromatic, and agreeable flavour; and of a pleasant, but acrid oleaginous taste.

Mace is carminative, stomachic, and astringent; and possesses all the virtues of nutmeg, but has less astringency.—The oils of mace and nutmeg, whether prepared by distillation or expression, are of much of the same nature, that they may be indiscriminately used for one another on all occasions. They give ease in cholics, and often in nephritic cases, taken internally from one drop to five or six of the distilled oil, or an equal quantity of the expressed; and externally, they are of use to rub paralytic limbs: they also assist digestion; and will often stop vomitings and hicoughs, only by being rubbed on the region of the stomach. The nurses have a custom of applying oil of mace by expression to childrens navels to ease their gripes, and that often with success; and we are assured, by authors of credit, that when rubbed on the temples, it promotes sleep.

MACEDON, or **MACEDONIA**, a most celebrated kingdom of antiquity, was bounded on the east by the *Ægean* sea; on the south by Thessaly and Epirus; on the west by the Ionian sea or Adriatic; on the north, at first by the river Strymon and the Scardian mountains, but afterwards by the river Nessus or Ne-¹stus. In a direct line the whole country extended ^{Situation,} only 150 miles in length; but the windings of the ^{&c. of the} coast lengthened it out to three times that extent; in which almost every convenient situation was occupied by a Grecian sea-port. The country was naturally divided by the Thermaic and Strymonic gulphs, into the provinces of Pieria, Chalcis, and Pangæus. The middle region, which took its name from a city of Eubœa from whence it was originally peopled, was very fertile and pleasant; the inland country, being diversified by lakes, rivers, and arms of the sea, was extremely convenient for inland navigation, while the towns of Amphipolis, Potidæa, Acanthus, and many others, afforded marts for the commerce of the republics of Greece, as well as of Thrace and Macedon. On one side of this district were the mountains of Pangæus, and on the other the plains of Pieria. The Pangæus ^{mountain}

Mace,
Macedon.

¹ Macedonia, mountains, which extended 90 miles towards the east and the river Nessus, though proper neither for corn nor pasture, produced plenty of timber for ship-building; while the southern branches of the mountain contained rich veins of gold and silver; but these, though wrought successfully by the Thians and the Athenians, were only brought to perfection by Philip of Macedonia, who extracted from them gold and silver to the value of 200,000l. Sterling annually. Pieria extended 50 miles along the Thermoic gulph, to the confines of Thessaly and mount Pindus. The inland part of the country was beautifully diversified with shady hills and fountains; and so admirably calculated for solitary walks and retirement, that the ancients looked upon it to be the favourite haunt of the muses, and accordingly bestowed upon them the title of *Pierides*.

² Different names.

In the most early times this country was called *Emathia*, from *Emathius* one of its princes. The name of *Macedon* is said to have been derived from *Macedo* a descendant of Deucalion; though others suppose it to have been only a corruption of *Mygdonia* a district of the country. In those remote ages of antiquity, Macedonia, like most other countries of Europe, was divided into a great number of petty principalities, of which scarce even the names are known at this time. All authors agree, however, that *Caranus* was the first who established any permanent sovereignty in Macedonia. He was an Argive, a descendant of Hercules, and about 800 years B. C. conducted a small colony of his countrymen into the inland district of Macedonia at that time distinguished by the name of *Emathia* as already mentioned. This territory was about 300 miles in circumference. On the south it was separated from the sea by a number of Greek republics, of which the most considerable were those of Olynthus and Amphipolis; and on the north, east, and west, was surrounded by the barbarous kingdoms of Thrace, Paeonia, and Illyricum. According to the traditions of those times, Caranus, having consulted the oracle on the success of his intended expedition, was commanded to be directed by the goats in the establishment of his empire. For some time he proceeded at random, without knowing what to make of the oracle's answer; but happening to enter the small kingdom of *Emathia*, at that time governed by King Midas, he observed a herd of goats running towards *Edeffa* the capital. Recollecting then the answer of the oracle, he attacked and took the city by surprise, soon after making himself master of the whole kingdom. In memory of this remarkable event he called the city *Ægea*, and the people *Ægiætes*, from the goats who conducted him, and made use of the figure of a goat in his standard. From this fable also we see why the figure of a goat is so frequently seen on the coins of Philip and his successors.

⁴ Policy of this prince.

The little colony of Argives led into *Emathia* by Caranus would soon have been overwhelmed by the barbarous nations who surrounded it, had not this prince and his subjects taken care to ingratiate themselves with their neighbours, rather than to attempt to subdue them by force of arms. They instructed them in the Grecian religion and government, and in the knowledge of many useful arts; adopting themselves, in some degree, the language and manners of the barbarians; imparting

Nº 189.

to them in return some part of the Grecian civilization and polite behaviour. Thus they gradually associated with the fierce and warlike tribes in their neighbourhood; and this prudent conduct, being followed by succeeding generations, may be looked upon as one of the causes of the Macedonian greatness.

Caranus, dying after a reign of three years, left the kingdom to his son Cenus; who having considerably enlarged his dominions, was succeeded by Thurymas, and he by Perdiccas I. This last prince is by Thucydides and Herodotus accounted the founder of the Macedonian monarchy; though his history is so obscured by fable, that nothing certain can now be known concerning it. In process of time, however, the good understanding which had subsisted between the Macedonians and their barbarous neighbours began to suffer an interruption; and in 691 B. C. the kingdom was for the first time invaded by the Illyrians. At first they did considerable damage by their ravages; but the Macedonian monarch, Argeus, having deceived them into an ambush, cut off great numbers, and obliged the remainder to leave the kingdom. In the reign of his successors, however, they returned, and occasionally proved very troublesome enemies till the reigns of Philip and Alexander.

In the mean time the kingdom of Macedonia began to be affected by those great events which took place in other parts of the world. Cyrus having overthrown the Babylonian empire, and conquered all the western part of Asia, established a mighty monarchy, which threatened all the eastern parts of Europe with subjection. The Greeks, however, having now emerged from their barbarism, and acquired great knowledge in the art of war, were able to resist effectually this very formidable power; but the kingdom of Macedonia, obscure and unconnected, was obliged to yield, and though not formally made a province of the Persian empire, was nevertheless accounted in some sort as under the vassalage and protection of the Persians. Alcetas, who ascended the Macedonian throne about the time that the Persian monarchy was founded, had the dexterity to preserve his dominions from the encroachments of the Greeks on the one hand, and of the Persians on the other; but in the reign of his successor Amyntas a formal demand was made of submission to the great King Darius, by sending him a present of earth and water. Seven ambassadors were sent on this errand by Megabizus, one of the officers of Darius. They were sumptuously entertained by Amyntas; but having attempted to take some indecent liberties with the Macedonian women, Alexander the king's son caused them all to be murdered. This rash action had almost proved the ruin of the kingdom; but Alexander found means to pacify Buzaris the general sent against him by Megabizus, by showing him his sister Gygea, a very beautiful woman, with whom the Persian fell in love at first sight, and afterwards married her.

From this time the Macedonians were accounted the faithful allies of the Persians; and, through the interest of his son-in-law, Amyntas obtained the country in the neighbourhood of mount Hæmus and Olympus, at the same time that the city of Alabanda in Phrygia was given to Amyntas the nephew of Alexander. The Macedonians distinguished themselves in the time

of

Macedon.

of the Persian invasion of Greece, by furnishing their allies with 200,000 recruits; though some cities, particularly Potidæa, Olynthus, and Pallene, adhered to the Grecian interest. The two last were taken and rased, and the inhabitants massacred by the Persians; but Potidæa escaped by reason of the sea breaking into the Persian camp, where it did great damage. Alexander, however, afterwards thought proper to court the favour of the Greeks by giving them intelligence of the time when Mardonius designed to attack them. The remaining transactions of this reign are entirely unknown, farther than that he enlarged his dominions to the river Nessus on the east and the Axios on the west.

9
Reign of
Perdiccas
II.

Alexander I. was succeeded by his son Perdiccas II. who, according to Dr Gillies, "inherited his father's abilities, though not his integrity." But from his duplicity above mentioned both to Greeks and Persians, it does not appear that he had much to boast of as to the latter quality. In the Peloponnesian war he espoused the cause of the Spartans against the Athenians, from whom he was in danger by reason of their numerous settlements on the Macedonian coast, and their great power by sea. For some time, however, he amused the Athenians with a show of friendship; but at last, under pretence of enabling Olynthus and some other cities to recover their liberties, he assisted in destroying the influence of the Athenians in those places, in hopes of establishing that of the Macedonians in its stead. But this design failed of success; the Olynthian confederacy was broken, and the members of it became subject to Sparta, until at last, by the misfortunes of that republic, they became sufficiently powerful not only to resist the encroachments of the Macedonians, but to make considerable conquests in their country.

10
Of Archelaus I.

Perdiccas II. was succeeded about 416 B. C. by Archelaus I. He enlarged his dominions by the conquest of Pydna, and other places in Pieria, though his ambition seems rather to have been to improve his dominions than greatly to extend them. He facilitated the communication between the principal towns of Macedon, by cutting straight roads through most part of the country: he built walls and fortresses in such places as afforded a favourable situation; encouraged agriculture and the arts, particularly those subservient to war; formed magazines of arms; raised and disciplined a considerable body of cavalry; and in a word, says Dr Gillies, added more to the solid grandeur of Macedon than had been done by all his predecessors put together. Nor was he regardless of the arts of peace. His palace was adorned by the works of Grecian painters. Euripides was long entertained at his court; Socrates was earnestly solicited to live there, after the example of this philosophic poet, formed by his precepts and cherished by his friendship: men of merit and genius in the various parts of literature and science were invited to reside in Macedon, and treated with distinguished regard by a monarch duly attentive to promote his own glory and the happiness of his subjects."

11
The kingdom becomes a prey to civil dissensions.

This great monarch died after a reign of six years, a space by far too short to accomplish the magnificent projects he had formed. After his death the kingdom fell under the power of usurpers or weak and

Vol. X. Part I.

wicked monarchs. A number of competitors constantly appeared for the throne; and these by turns called in to their assistance the Thracians, Illyrians, Thessalians; the Olynthian confederacy, Athens, Sparta, and Thebes. Bardyllis, an active and daring chief, who, from being head of a gang of robbers, had become sovereign of the Illyrians, entered Macedon at the head of a numerous army, deposed Amyntas II. the father of Philip, and set up in his place one Argæus, who consented to become tributary to the Illyrians. Another candidate for the throne, named *Pausanias*, was supported by the Thracians; but, by the assistance of the Thessalians and Olynthians, Amyntas was enabled to resume the government. After his restoration, however, the Olynthians refused to deliver up several places of importance belonging to Macedon which Amyntas had either entrusted to their care, or which they had taken from his antagonist. Amyntas complained to Sparta; and that republic, which had already formed schemes of the very extensive ambition, so readily complied with the request, that it was generally supposed to have proceeded from Spartan emissaries sent into Macedonia. They pretended indeed to hesitate a little, and to take time to deliberate on the army which ought to be raised for the purpose; but Cleigènes, the principal ambassador, represented the urgency of the case in such a manner, that the troops which happened at that time to be ready were ordered to take the field without delay. Two thousand Spartans, under the command of Eudamidas, were ordered into Macedon, while a powerful reinforcement under the command of Phæbidas, brother to the general, was ordered to follow him as soon as possible. By accident, Phæbidas and his auxiliaries were detained till the season for action was passed; but Eudamidas with his small army performed very essential service. The appearance of a Spartan army at once encouraged the subjects and allies of the Olynthians to revolt; and the city of Potidæa, a place of great importance in the isthmus of Pallene, surrendered soon after his arrival in the country. Being too much elated with his success, however, Eudamidas approached so near the city of Olynthus, that he was unexpectedly attacked, defeated, and killed in a sally of the citizens. He was succeeded by Teleutias the brother of Agæislaus, who had under his command a body of 10,000 men, and was farther assisted by Amyntas king of Macedon and Derdas his brother, the governor or sovereign of the most westerly province of Macedon, which abounded in cavalry. By these formidable enemies the Olynthians were defeated in a number of battles, obliged to shut themselves up in their city, and prevented from cultivating their territory; on which Teleutias advanced with his whole forces to invest the city itself. His excessive eagerness to destroy his enemies proved his ruin. A body of Olynthian horse had the boldness to pass the river Amnias in sight of the allied army, though so much superior in number. Teleutias ordered his targeters to attack them, the Olynthians, having retreated across the river, were closely pursued by the Lacedæmonians, great part of whom also passed the river; but the Olynthians suddenly turning upon them, killed upwards of 100, with Tlemonidas their leader. Teleutias, exasperated at this disaster, ordered

11
War with
the Olynthians.

Macedon.

ordered the remainder of the targeteers and cavalry to pursue; while he himself advanced at the head of the heavy armed foot with such celerity that they began to fall into disorder. The Olynthians allowed them to proceed, and the Lacedæmonians very imprudently advanced just under the towers and battlements of the city. The townsmen then mounted the walls, and discharged upon them a shower of darts, arrows, and other missile weapons, while the flower of the Olynthian troops, who had been purposely posted behind the gates, sallied forth and attacked them with great violence. Teleutias attempting to rally his men, was slain in the first onset; the Spartans who attended him were defeated, and the whole army at last dispersed with great slaughter, and obliged to shelter themselves in the towns of Acanthus, Apollonia, Spartolus, and Potidea.

The Spartans, undismayed by this terrible disaster, next sent their King Agesiopolis with a powerful reinforcement into Macedon. His presence greatly raised the spirits of the Lacedæmonian allies, and his rapid success seemed to promise a speedy termination to the war, when he himself died of a calenture. He was succeeded in the throne by his brother Cleombrotus, and in the command of the army by Polybiades an experienced general, who likewise brought along with him a powerful reinforcement. Olynthus was now completely blocked up by land, while a squadron of Lacedæmonian galleys blocked up the neighbouring harbour of Myceberna. The Olynthians, however, held out for nine or ten months, but at last were obliged to submit on very humiliating conditions. They formally renounced all claim to the dominion of Chalcis; they ceded the Macedonian cities to their ancient governor; and in consequence of this Amyntas left the city of *Ægeæ* or *Edeffa*, where till now he had held his royal residence, and fixed it at Pella, a city of great strength and beauty, situated on an eminence, which together with a plain of considerable extent was defended by impassable morasses, and by the rivers *Axius* and *Lydias*. It was distant about 15 miles from the *Ægean* sea, with which it communicated by means of the abovementioned rivers. It was originally founded by the Greeks, who had lately conquered and peopled it; but in consequence of the misfortunes of Olynthus, it now became the capital of Macedon, and continued ever after to be so.

Amyntas, thus fully established in his dominions, continued to enjoy tranquillity during the remaining part of his life. The reign of his son Alexander was short, and disturbed by invasions of the Illyrians; from whom he was obliged to purchase a peace. He left behind him two brothers, *Perdiccas* and *Philip*, both very young; so that *Paufanias* again found means to usurp the throne, being supported not only by the Thracians, but a considerable number of Greek mercenaries, as well as a powerful party in Macedon itself. In this critical juncture, however, Iphicrates the Athenian happening to be on an expedition to Amphipolis, was addressed by Eurydice the widow of Amyntas, so warmly in behalf of her two sons, whom she presented to him, that he interested himself in their behalf, and got *Perdiccas* the eldest established on the throne. He was induced also to this piece of generosity by the kindness which Eurydice and her

husband had formerly shown to himself, and he likewise saw the advantages which must ensue to his country from a connection with Macedon. During the minority of the young prince, however, his brother *Ptolemy*, who was his guardian, openly aspired to the throne; but he was deposed by the Theban general *Pelopidas*, who reinflated *Perdiccas* in his dominions; and in order to secure, in the most effectual manner, the dependence of Macedon upon Thebes, carried along with him thirty Macedonian youths as hostages; and among them *Philip*, the younger brother of the king. *Perdiccas* now, elated by the protection of such powerful allies, forgot *Iphicrates* and the Athenians, and even disputed with them the right to the city of *Amphipolis*, which had been decreed to them by the general council of Greece, but which his opposition rendered impossible for them to recover. In consequence of the trust he put in these new allies, also, it is probable that he refused to *Bardyllis* the Illyrian the tribute which the Macedonians had been obliged to pay him; which occasioned a war with that nation. In this contest the Macedonians were defeated with the loss of 4000 men, *Perdiccas* himself being taken prisoner, and dying soon after of his wounds.

The kingdom was now left in the most deplorable state. *Amyntas*, the proper heir to the throne, was an infant; the Thebans, in whom *Perdiccas* had placed so much confidence, were deprived of the sovereignty of Greece; the Athenians, justly provoked at the ungrateful behaviour of the late monarch, showed an hostile disposition; the Illyrians ravaged the west, and the *Peonians* the north quarter of the kingdom; the Thracians still supported the cause of *Paufanias*, and proposed to send him into Macedon at the head of a numerous army; while *Argæus*, the former rival of *Amyntas*, renewed his pretensions to the throne, and by flattering the Athenians with the hopes of recovering *Amphipolis*, easily induced them to support his claims; and in consequence of this they fitted out a fleet, having on board 3000 heavy armed soldiers, which they sent to the coast of Macedon.

Philip, the late king's brother, no sooner heard of his defeat and death, than he set out privately from *Thebes*; and on his arrival in Macedon found matters in the situation we have just now described. Fired with an insatiable ambition, it is very probable that from the very first moment he had resolved to seize the kingdom for himself; yet it was necessary at first to pretend that he assumed the throne only to preserve it for his nephew. *Philip*, as has already been mentioned, was carried off as an hostage by *Pelopidas*, but for a long time past had remained in such obscurity, that historians disagree as to his place of residence; some placing him in Thebes, and others in Macedon. It is certain, however, that from the age of 15 he had been very much in the family of *Epaminondas*, from whose lessons he could not but derive the greatest emolument. It is probable also that he attended this celebrated general in many of his expeditions; and it is certain, that, with an attendance suitable to his rank, he visited most of the principal republics, and showed an attention to their institutions, both civil and military, far superior to his years. Having easy access to whomsoever he pleased, he cultivated the friendship of the first people in Greece. Even in Athens, where

Macedon.

16
Ptolemy
aspires to
the throne.

17
The Ma-
cedonians
defeated,
and their
king killed
by the Il-
lyrians.

13
The Olyn-
thians obli-
ged to sub-
mit.

14
Pella made
the capital
of Macc-
don.

15
Paufanias
usurps the
throne.

18
Philip ar-
rives in
Macedon.

Macedon.

Macedon.

19
Retrieves
the affairs
of the king-
dom.

where no good-will subsisted with Macedon, the philosophers Plato, Ilocrates, and Aristotle, cultivated his acquaintance : and the connection he formed with the principal leaders of that republic in the early period of his life, no doubt contributed greatly to the accomplishment of the designs in which he afterwards proved so successful. His appearance in Macedon instantly changed the face of affairs: the Macedonian army, though defeated, was not entirely destroyed ; and the remainder of them secured themselves in the fortresses which had been built by Archelaus. There were also considerable garrisons in the fortresses, and walled towns scattered over the kingdom ; and the Illyrians, who had made war only for the sake of plunder, soon returned home to enjoy the fruits of their victory. His other enemies, the Thracians and Pæonians, were much less formidable than the Illyrians, being still in a very rude and uncivilized state, incapable of uniting under one head in such a manner as to bring any formidable army into the field. While the Illyrians therefore gave up the campaign through mere caprice and unsteadiness, Philip himself applied to the Pæonians, and by fair promises and flattery prevailed upon them to desert. The king of Thrace, by means of a sum of money, was easily prevailed upon to abandon the cause of Pausanias ; so that Philip, freed from these barbarians, was now left at liberty to oppose the Athenians, who supported Argæus, and threatened a very formidable invasion.

20
Takes up-
on him the
sovereign-
ty.

The appearance of the Athenian fleet before Methone, with that of Argæus at the head of a numerous army in Pieria, filled the whole country with consternation ; and Philip, who was by no means deficient in talents necessary to recommend himself to the good graces of the people, took the opportunity of getting Amyntas set aside, and himself declared king ; for which indeed the danger of the times afforded a very plausible pretext. Argæus, in the mean time, advanced with his Athenian allies towards Edeffa, or *Ægæ*, the ancient capital of the Macedonian empire, where he hoped to have been amicably received ; but finding the gates shut against him, he returned back to Methone. Philip harassed him in his retreat, cutting off great numbers of his men, and afterwards defeated him in a general engagement ; in which Argæus himself, with the flower of his army, was cut in pieces, and all the rest taken prisoners.

21
Defeats and
kills Argæ-
us on an unex-
pected.

This first instance of success contributed greatly to raise the spirits of Philip's party ; and he himself took care to improve it in the best manner possible. Having taken a great number of prisoners, both Macedonians and Athenians, he determined, by his treatment of them, to ingratiate himself with both parties. The former were called into his presence, and, after a gentle reprimand, admitted to swear allegiance to him ; after which they were distributed through the army : the Athenians were entertained at his table, dismissed without ransom, and their baggage restored. The prisoners were just allowed time to return to their native city and to spread abroad the news of Philip's generosity, when they were followed by ambassadors from Macedon with proposals for peace. As he knew that the loss of Amphipolis had greatly irritated them, he now thought proper to renounce his jurisdiction over that city ; and it was accordingly declared free

22
Philip's po-
litical treat-
ment of his
prisoners.23
Renounces
his right to
Amphipoli-
s.

and independent, and subject only to the government of its own free and equitable laws. This artful conduct, together with his kind treatment of the prisoners, so wrought upon the minds of the Athenians, that they consented to the renewal of a treaty which had formerly subsisted between them and his father Amyntas. Thus he found means to remove all jealousy of his ambition or the schemes he might afterwards undertake to their prejudice ; and not only this, but to induce them to engage in a ruinous war with their allies, which occupied their attention until Philip had an opportunity of getting his matters so well established that it was impossible to overthrow them.

24
Reduces the
power of
the nobili-
ty.

The new king being thus left at liberty to regulate his domestic concerns, began to circumscribe the power of his chiefs and nobles ; who, especially in the more remote provinces, paid very little regard to the authority of the kings of Macedon ; sometimes, even in times of public calamity, throwing off their allegiance altogether, and assuming an independent government over considerable tracts of country. To counteract the ambition of these chiefs, Philip chose a body of the bravest Macedonian youths, whom he entertained at his own table, and honoured with many testimonies of his friendship, giving them the title of his *companions*, and allowing them constantly to attend him in war and hunting. Their intimacy with the sovereign, which was considered as an indication of their merit, obliged them to superior diligence in all the severe duties of military discipline ; and the young nobility, eager to participate such high honours, vied with each other in their endeavours to gain admission into this distinguished order ; so that while on the one hand they served as hostages, on the other they formed an useful seminary for future generals, by whom both Philip and Alexander were afterwards greatly assisted in their conquests.

25
number of
illustrious
young men
for his com-
panions.

Diodorus Siculus, and all the Roman writers who have treated of the history of Greece, assert that Philip, in the first year of his reign, instituted the Macedonian phalanx ; a body of 6000 men armed with short swords fitted either for cutting or stabbing, having also strong bucklers four feet long and two and an half broad, and pikes 14 feet long ; usually marching 16 men deep. But this opinion is controverted by others. Dr Gillies supposes that the opinion had arisen from the Romans meeting with the phalanx in its most complete form in Macedon ; and as they became acquainted with Greece and Macedon pretty nearly at the same time, it was natural for them to suppose that it had been invented among the Macedonians. The phalanx, he says, is nothing different from the armour and arrangement which had always prevailed among the Greeks, and which Philip adopted in their most perfect form ; " nor is there reason (says he) to think that a prince, who knew the danger of changing what the experience of ages had approved, made any alteration in the weapons or tactics of that people. The improvement in the counter-march, to which Philip gave the appearance of advancing instead of retreating, mentioned by Ælian in his *Tactics*, c. xxviii. was borrowed, as this author tells us, from the Lacedæmonians. If Philip increased the phalanx, usually less numerous, to 6000 men, this was far from an improvement ; and the later kings of

26
Whether
he instituted
the phalanx.

Macedon. Macedon, who swelled it to 16,000, only rendered that order of battle more unwieldy and inconvenient." Instead of this, Philip, according to our author, employed himself in procuring arms, horses, and other necessary materials for war; and in introducing a more severe and exact military discipline than had formerly been known in Macedon.

27
Overcomes
the Pæo-
nians and
Illyrians.

While the king thus took the best methods to render himself secure at home and formidable abroad, the Pæonians again began to make incursions into the kingdom. The death of Agis their king, however, who was a man of great military skill, deprived them almost of every power of resistance when they were attacked. Philip, of consequence, over-ran their country with little opposition, and reduced them to the state of tributaries to Macedon. No sooner was this accomplished, than he undertook a winter's campaign against the Illyrians, who had long been the natural enemies of Macedon. They had now extended their territory to the east; by which means the Macedonians were excluded from the harbours on the coast of the Adriatic. This was a grievance to Philip, who seems early to have meditated the raising of a naval power; neither could he hope to be in safety, should the kingdom be left open to the incursions of a barbarous enemy: for which reasons he determined at once to humble those enemies in such a manner that they should no longer be in a situation to give him any disturbance. After an ineffectual negotiation, he was met by Bardyllis at the head of a considerable body of infantry, but with only 400 horse. They made a gallant resistance for some time; but being unable to cope with such a skilful general as Philip, they were defeated with the loss of 7000 men, among whom was their leader Bardyllis, who fell at the age of 90.

28
They are
forced to
become
tributary.

By this disaster the Illyrians were so much disheartened, that they sent ambassadors to Philip, humbly begging for peace on any terms. The conqueror granted them the same conditions which had been imposed upon the Pæonians, viz. the becoming tributary, and yielding up to him a considerable part of their country. That part of it which lay to the eastward of a lake named Lynchnidus he annexed to Macedon; and probably built a town and settled a colony there; the country being fertile, and the lake abounding with many kinds of fish highly esteemed by the ancients. This town and lake were about 50 miles distant from the Ionian sea; and such was the ascendancy which the arms and policy of Philip acquired over his neighbours, that the inhabitants of all the intermediate district soon adopted the language and manners of their conquerors; and their territory, hitherto unconnected with any foreign power, sunk into such absolute dependence upon Macedon, that many ancient geographers supposed it to be a province of that country.

29
His great
designs.

Philip had no sooner reduced the Illyrians, than he began to put in execution greater designs than any he had yet attempted. The rich coasts to the southward of Macedon, inhabited chiefly by Greeks, presented a strong temptation to his ambition and avarice. The confederacy of Olynthus, after having thrown off the yoke of Sparta, was become more powerful than ever, and could send into the field an army of 10,000 heavy armed troops, besides a number of cavalry in propor-

tion. Most of the towns in Chalcidice were become **Macedon.** its allies or subjects; so that this populous and wealthy province, together with Pangæus on the right and Pieria on the left, of both which the cities were either independent or subject to the Athenians, formed a barrier not only sufficient to guard against any incursions of the Macedonians, but which was even formidable to them. But though Philip was sensible enough of the importance of those places, he considered the conquest of Amphipolis as more necessary of Amphipolis at the present time. By the possession of this place Macedon would be connected with the sea, and would be secured in many commercial advantages, which could not but contribute greatly to the prosperity of the kingdom at large; a road was likewise opened to the woods and mines of Pangæus, the former of which were so necessary to the raising of a naval power, and the latter for the establishment of a proper military force. This city had indeed been declared independent by Philip himself in the beginning of his reign; but this was only to prevent a rupture with the Athenians, who still asserted their right to it as an ancient colony; though, by reason of the peridy of Charidemus, a native of Eubœa, they had hitherto failed in their attempts to recover it. The Amphipolitans, however, having once enjoyed the sweets of liberty, prepared to maintain themselves in their independence. In the mean time the hostile designs of Philip, which all his precaution had not been able to conceal, alarmed the inhabitants to such a degree, that they thought proper to put themselves under the protection of the Olynthians. By them they were readily received into the confederacy; and, trusting to the strength of their new allies, behaved in such an insolent manner to Philip, that he was not long of finding a specious pretext for hostility; at which the Olynthians, greatly alarmed, sent ambassadors to Athens, requesting their assistance against such a powerful enemy. Philip, however, justly alarmed at such a formidable conspiracy, sent agents to Athens, with such expedition that they arrived there before any thing could be concluded with the Olynthian deputies. Having gained over the popular leaders and orators, he deceived and flattered the magistrates and senate in such an artful manner, that a negotiation was instantly set on foot, by which Philip engaged to conquer Amphipolis for the Athenians, upon condition that they surrendered to him the strong fortrefs of Pydna, a place which he represented as of much less importance to them; promising also to confer upon them many other advantages, which, however, he did not specify at that time. Thus the Athenians, deceived by the peridy of their own magistrates, elated with the hopes of recovering Amphipolis, and outwitted by the superior policy of Philip, rejected with disdain the proffers of the Olynthians.

The ambassadors of Olynthus returned home highly disgusted with the reception they had met with; but had scarce time to communicate the news to their countrymen, when the ambassadors of Philip arrived at Olynthus. He pretended to console with them on the affront they had received at Athens; but testified his surprise that they should court the assistance of that distant and haughty republic, when they could avail themselves of the powerful kingdom of Macedon, which

30
Plans the
conquest
of Amphipolis.

31
Engages to
conquer it
for the A-
thenians.

wished.

³² Macedon. wished for nothing more than to enter into equal and lasting engagements with their confederacy. As a proof of his moderation and sincerity, he offered to put them in possession of Anthemus, an important town in the neighbourhood, of which the Macedonians had long claimed the jurisdiction, making many other fair promises; and among the rest, that he would reduce for them the cities of Pydna and Potidæa, which he chose rather to see in dependence on Olynthus than Athens. Thus he prevailed upon the Olynthians not only to abandon Amphipolis, but to assist him with all their power in the execution of his designs.

Philip now lost no time in executing his purposes on Amphipolis; and pressed the city so closely, that the people were glad to apply to the Athenians for relief. Accordingly they dispatched two of their most eminent citizens, Hierax and Stratocles, to represent the danger of an alliance betwixt Philip and the Olynthians, and to profess their sorrow for having so deeply offended the parent state. This representation had such an effect, that though the Athenians were then deeply engaged in the social war, they would probably have paid some attention to the Amphipolitans, had not Philip taken care to send them a letter with fresh assurances of friendship, acknowledging their right to Amphipolis, and which he hoped shortly to put into their hands in terms of his recent agreement. By these specious pretences the Athenians were persuaded to pay as little regard to the deputies of the Amphipolitans as they had already done to those of the Olynthians; so that the city, unable to defend itself alone against so powerful an enemy, surrendered at last at discretion in the year 357 B.C.

Philip still proceeded in the same cautious and politic manner in which he had begun. Though the obstinate defence of the Amphipolitans might have furnished a pretence for severity, he contented himself with banishing a few of the popular leaders from whom he had most cause to dread opposition, treating the rest of the inhabitants with all manner of clemency; but took care to add Amphipolis to his own dominions, from which he was determined that it never should be separated, notwithstanding the promises he had made to the Athenians. Finding that it was not his interest at this time to fall out with the Olynthians, he cultivated the friendship of that republic with great assiduity; took the cities of Pydna and Potidæa, which he readily yielded to the Olynthians, though they had given him but little assistance in the reduction of these places. Potidæa had been garrisoned by the Athenians; and them the artful king sent back without ransom, lamenting the necessity of his affairs which obliged him, contrary to his inclination, to oppose their republic. Though this was rather too gross, the Athenians at present were so much engaged with the social war, that they had not leisure to attend to the affairs of other nations. Philip made the best use of his time, and next projected the conquest of the gold mines of Thrace. That rich and fertile country was now held by one Cotys, a prince of such weak intellectual faculties, that the superstition of the Greeks, into which he was newly initiated, had almost entirely subverted his reason; and he wandered about in quest of the goddess Minerva with whom he fancied himself in love. The invasion of the Macedonians, however,

awaked him from his reverie; and Cotys, finding himself destitute of other means of opposition, attempted to stop the progress of the enemy by a letter. To this Philip paid no regard; the Thracians were instantly expelled from their possessions at Crenida, where there were very valuable gold mines. These had formerly been worked by colonies from Thasos and Athens; but the colonists had long since been expelled by the barbarous Thracians, who knew not how to make use of the treasure they were in possession of. Philip took the trouble to defend into the mines himself, in order to inspect the works; and having caused them to be repaired, planted a Macedonian colony at Crenida, bestowed upon it the name of Philippi, and drew annually from the gold mines to the value of near 1000 talents, or 200,000 l. sterling; an immense sum in those days. The coins struck here were likewise called Philippi.

Philip having obtained this valuable acquisition, ³⁴ the next took upon him to settle the affairs of Thessaly, affairs of where every thing was in confusion. This country Thessaly had been formerly oppressed by Alexander tyrant of Pheræ; after whose death three others appeared, viz. Tisiphornus, Pitolaus, and Lycophron, the brothers-in-law of Alexander, who had likewise murdered him. By the united efforts of the Thessalians and Macedonians, however, these usurpers were easily overthrown, and effectually prevented from making any disturbances for the future; and the Thessalians, out of a mistaken gratitude, surrendered to Philip all the revenues arising from their fairs and towns of commerce, as well as all the conveniences of their harbours and shipping; a concession which Philip took care to secure in the most effectual manner.

Having now not only established his sovereignty in the most effectual manner, but rendered himself very powerful and formidable to his neighbours, Philip determined to enjoy some repose from his fatigues. ³⁵ Having formed an alliance with Arybbas king of Epirus, Olympias, he, in the year 357 B.C. married Olympias the sister of that prince; a match thought the more eligible, as the kings of Epirus were supposed to be descended from Achilles. The nuptials were solemnized at Pella with great pomp, and several months were spent in shows and diversions; during which Philip showed such an extreme proneness to vice of every kind, as disgraced him in the eyes of his neighbours, and most probably laid the foundation of his future domestic unhappiness. So much was this behaviour of the Macedonian monarch taken notice of by the neighbouring ³⁶ combinations, that the Pæonians and Illyrians threw off the yoke, engaging in their schemes the king of Thrace, the neighbourhood, and notwithstanding the infame state of that prince, their intrigues were now carried on with more judgment than formerly was usual with barbarians. Philip, however, notwithstanding his dissipation, got warning of his danger in sufficient time to prevent the bad consequences which might have ensued had the confederates got time to bring their matters to a proper bearing. Early in the spring 356 he took the field with the flower of the Macedonian troops. Having marched in person against the Pæonians and Thracians, he dispatched Parmenio his best general into Illyria. Both enterprises proved successful; and while Philip returned victorious from Thrace, he received an account of the enemies' victory.

Macedon.

38
Birth of
Alexander
the Great.39
Aristotle
appointed
his preceptor.40
Extent of
the Macedonian
territories.41
Projects
the conquest
of Olynthus
and of all
Greece.42
Account of
the Phocian
war.

victory gained by Parmenio; a second messenger informed him of a victory gained by his chariot at the Olympic games; and a third, that Olympias had been delivered of a son at Pella. This was the celebrated Alexander, to whom the diviners prophesied the highest prosperity and glory, as being born in such auspicious circumstances.

A short time after the birth of Alexander, Philip wrote a letter to the philosopher Aristotle, whom he chose for preceptor to his young son. The letter was written with great brevity, containing only the following words: "Know that a son is born to us. We thank the gods not so much for their gift, as for bestowing it at a time when Aristotle lives. We assure ourselves that you will form him a prince worthy of his father, and worthy of Macedon." He next set about the farther enlargement of his territories, which were already very considerable. *Pæonia* was now one of his provinces; on the east his dominions extended to the sea of *Thalos*, and on the west to the lake *Lychnidus*. The *Theſſalians* were in effect subject to his jurisdiction, and the possession of *Amphipolis* had secured him many commercial advantages; he had a numerous and well-disciplined army, with plentiful resources for supporting such an armament, and carrying through the other schemes suggested by his ambition; though his deep and impenetrable policy rendered him more truly formidable than all these put together. His first scheme was the reduction of *Olynthus*, the most populous and fertile country on the borders of Macedon; after which his ambition prompted him to acquire the sovereignty of all Greece. To accomplish the former, he had hitherto courted the friendship of the *Olynthians* by every possible method; and without letting slip any opportunity to accomplish the latter, he deprived the *Athenians* gradually of several of their settlements in *Thrace* and *Macedon*. In these depredations, however, he took care always to give such appearance of justice to his actions, that his antagonists, who had studied the matter less deeply, could not find a plausible pretext for engaging in war against him, even when he had openly committed hostilities against them. Philip easily perceived that the affairs of the Greeks were coming to a crisis, and he determined to wait the event of their mutual dissensions. That event did not disappoint his hopes. The *Phocians* had violated the religion of those days in a most extraordinary manner; they had even ploughed up the lands consecrated to *Apollo*; and however they might pretend to excuse themselves by examples, the *Amphictyons* fomented a decree against the *Phocians*, commanding the sacred lands to be laid waste, and imposing an heavy fine upon the community.

By this decree all Greece was again involved in the war called *Phocian*, from the name of the city about which it commenced. Philip at the beginning of the troubles was engaged in *Thrace*, where a civil war had taken place among the sons of *Cotyis*; and wherever Philip interfered, he was sure to make matters turn out to his own advantage. His incroachments at length became so enormous, that *Kerobletes*, the most powerful of the contending princes, agreed to cede the *Thracian Chersonesus* to the *Athenians*; who immediately sent *Chares* at the head of a powerful armament to take possession of it. In this expedition

the town of *Sestos* was taken by storm, and the inhabitants cruelly treated by *Chares*, while Philip employed himself in the siege of *Methone* in *Pieria*. This city he likewise reduced; but the king lost an eye at the siege in the following extraordinary manner, if we may give credit to some ancient historians. A celebrated archer, named *Aster*, had it seems offered his services to Philip, being represented as such an excellent marksmanship, that he could hit the swiftest bird on the wing. Philip replied, that he would be of excellent use if they were to make war with starlings. *Aster*, disgusted with this reception, went over to the enemy, and with an arrow wounded the king in the eye. When the weapon was extracted, it was found to have on it the following inscription: "For the right eye of Philip." The king ordered the arrow to be shot back again, with another inscription, importing that he would cause *Aster* to be hanged when the town was taken. A report was raised after Philip's death, that he had lost his eye by prying too narrowly into the amours of *Olympias* and *Jupiter Ammon*; which the vanity of his successor prompted him to cherish, as his flatterers had probably been the inventors of it.

All this time the *Phocian* war raged with the greatest fury, and involved in it all the states of Greece. *Lycophron*, one of the *Theſſalian* tyrants, whom Philip had formerly deprived of his authority, had again found means to re-establish his authority; and his countrymen having taken part with the *Phocians*, *Lycophron* called in *Onomarchus* the *Phocian* general to protect him against the power of Philip, by whom he was sensible that he would soon be attacked. The king accordingly marched into *Theſſaly* with a considerable army, defeated *Phyllus* the brother of *Onomarchus*, whom the latter had sent into the country with a detachment of 7000 men. After this he besieged and took the city of *Pegaste*, driving the enemy towards the frontiers of *Phocis*. *Onomarchus* then advanced with the whole army; and Philip, though inferior in numbers, did not decline the engagement. The *Phocians* at first gave ground, on which the *Macedonians* pursued, but in good order; but coming near a precipice, on the top of which *Onomarchus* had posted a detachment of soldiers, the latter rolled down stones and fragments of the rock in such a manner as did dreadful execution, and threw them into the utmost disorder. Philip, however, rallied his troops with great presence of mind, and prevented the *Phocians* from gaining any farther advantage than they had already done; saying, as he drew off his men, that they did not retreat through fear, but like rams, in order to strike with the greater vigour. Nor was he long before he made good his assertion; for having recruited his army with the greatest expedition, he returned into *Theſſaly* at the head of 20,000 foot and 500 horse, where he was met by *Onomarchus*. The *Macedonians* at this time were superior in number to their enemies; and Philip moreover took care to remind them, that their quarrel was that of heaven, and that their enemies had been guilty of sacrilege, by profaning the temple of *Delphi*. That they might be still more animated in the cause, he put crowns of laurel on their heads. Thus fired by enthusiasm, and having besides the advantage of numbers, the *Phocians* were altogether unable to withstand them. They threw away

Macedon.

43
Philip loses
an eye at
the siege
of Methone.44
Is engaged
in a war
with Onomarchus
the Phocian
general,
who de-
feats him;46
But is at
last defeat-
ed and kill-
ed.

Macedon. their arms and fled towards the sea, where they expected to have been relieved by Phares, who, with the Athenian fleet, was nigh the shore: but in this they were disappointed, for he made no attempt to save them. Upwards of 6000 perished in the field of battle or in the pursuit, and 3000 were taken prisoners. The body of Onomarchus being found among the slain, was by order of Philip hung up on a gibbet as a mark of infamy, on account of his having polluted the temple; the bodies of the rest were thrown into the sea, as being all partakers of the same crime. The fate of the prisoners is not known, by reason of an ambiguity in a sentence of Diodorus Siculus, which may imply that they were drowned, though it does not expressly say so.

47 Philip pursue his ambitious schemes. After this victory, Philip set about the settlement of Thessaly, waiting only for an opportunity to put in execution his favourite scheme of invading Greece. In the mean time, he rejoiced to see the states weakening each other by their mutual dissensions; of which he never failed to take advantage as far as possible. He now, however, began to throw off the mask with regard to the Olynthians, whom he had long deceived with fair promises. Having detached Kerobolotes from the interest of the Athenians, he established him in the sovereignty of Thrace; not out of any good will, but with a view to destroy him whenever a proper opportunity offered. Were he once possessed of the dominions of that prince, the way to Byzantium was open to him; the possession of which must have been a great temptation to Philip, who well knew how to value the importance of its situation both with respect to commerce and war: and in order to pave the way to this important conquest, he attacked the fortresses of Herzeum, a small and in itself unimportant place, though, by reason of its neighbourhood to Byzantium, the acquisition was valuable to Philip. The Athenians, however, at last began to perceive the designs of Philip, and determined to counteract them.

he was still enabled to make a very formidable appearance; and the Phocians took the field with great prospect of success.

Philip now thought it time to throw off the mask entirely, for which the proceedings of the Athenians, particularly their league with Olynthus, furnished him with a plausible pretext; and the revenging such horrid sacrifice as had been committed at Delphi seemed to give him a title to march at the head of an army into Greece. The superstition of the Greeks, however, had not yet blinded them to such a degree, but they could easily perceive that Philip's pious was a mere pretence, and that his real design was to invade and conquer the whole country. The Athenians no sooner heard of the march of the Macedonian army, than they dispatched, with all expedition, a strong guard to secure the pass of Thermopylæ; so that Philip was obliged to return greatly chagrined and disappointed. Their next step was to call an assembly to deliberate upon the measures proper to be taken in order to restrain the ambition of the Macedonian monarch; and this assembly is rendered memorable by the first appearance of Demosthenes as an orator against Philip. Athens for some time had been in a very alarming situation. They were deeply involved

in the sacred war; their northern possessions were continually insulted and plundered by Philip; while a number of his mercenary partisans drew off the public attention to such a degree, that, instead of taking measures to counteract that ambitious prince, they amused themselves with speculations about the designs of the Persian monarch, who was preparing for war against the Cyprians, Egyptians, and Phœnicians. I-⁵²sochrates the celebrated orator, and Phocion the states-^{Extremes}man, joined the multitude in their present opinion, though not from any mercenary motives, but purely from a sense of the unsteady conduct of the Athenians;^{Indolence and carelessness of the Athenians,} who, they were assured, could not contend with a prince of the vigour and activity of Philip; and therefore exhorted them by all means to cultivate the friendship of Philip, whom they could not oppose with any probability of success. Isochrates, indeed, greatly with-⁵³ed for an expedition into Asia, and looked upon Phi-^{Advice of Isochrates the orator to them.}lip to be the only general capable of conducting it, though at present the Greeks had no pretence for making war upon the Persians, but that of revenging former injuries; and on this subject he addressed a discourse to Philip himself; and it is even said, that Isochrates, by the power of his rhetoric, prevailed upon Philip and the Athenians to lay aside their animosities for a short time, and consent to undertake this expedition in conjunction.

If this condition, however, did really take place, it was of very short duration. The views of Phloion and Iocrates were violently opposed by Demofthènes. Though sensible of the corruption and degeneracy of his countrymen, he hoped to be able to rouse them from their lethargy by dint of his eloquence; a talent he had been at great pains to cultivate, and in which he is said to have excelled all men that ever existed.

In his first addresses to the people, this celebrated orator exhorted them to awake from their indolence, and to assume the direction of their own affairs. They had been too long governed, he said, by the incapacity

Macedon.

city of a few ambitious men, to the great disadvantage as well as disgrace of the community. In the first place, an orator who had placed himself at the head of a faction of no more than 300 or 400, availed himself and his followers of the carelessness and negligence of the people to rule them at pleasure. From a consideration of their present weakness and corruption, as well as of the designs and commotions of the neighbouring powers, he advised them to abandon all romantic and distant schemes of ambition; and instead of carrying their arms into remote countries, to prepare for repelling the attacks which might be made upon their own dominions. He insisted also upon a better regulation of their finances, a more equal distribution of the public burthens, in proportion to the abilities of those upon whom they were laid, and upon the retrenching many superfluous expences. Having pointed out in a strong light the vigorous conduct of Philip; and shown by what means he had attained to such a respectable footing in the world, he next laid down a proper plan for their military operations. He told them, that they were not yet prepared to meet Philip in the field; they must begin with protecting Olynthus and the Chersonesus, for which it would be necessary to raise a body of 2000 light armed troops, with a due proportion of cavalry, which ought to be transported under a proper convoy to the islands of Lemnos, Thafos, and Sciatbos, in the neighbourhood of Macedon. In these they would enjoy all kinds of necessaries in abundance, and might avail themselves of every favourable incident, to appear at the first summons of their allies; and either to repel the incursions of the Macedonians, or harass their territories. While this was going on, more vigorous preparations might be made for war at home; and it was proposed, that only the fourth part of the Athenian citizens should enlist, and no more supplies were wanted at present but go talents. But notwithstanding the moderation of these proposals, and the urgent necessities of the state, it was impossible to prevail upon the indolent and careless Athenians to provide for their own safety. They appear, indeed, at this time, to have been desperately sunk in effeminacy and dissipation; which disposition Philip took care to encourage to the utmost of his power. There was an assembly in the city called the *Sixty*, from their consulting originally of that number, who met expressly for the purposes of extinguishing all care about public affairs, and to intoxicate themselves with every kind of pleasure they had in their power. With this assembly Philip was so well pleased, that he sent them money to support their extravagancies; and so effectually did they answer his purposes, that all the eloquence of Demosthenes could not counteract the speeches of orators much his inferiors when backed by Macedonian gold.

Philip himself, as we have already hinted, was excessively debauched in his private character, and the most shameful stories are related of him by the ancient writers, particularly by Demosthenes. Theopompus too, an author who flourished in the time of Alexander, and was rewarded and honoured by that monarch, also speaks of him in such terms as we cannot with decency relate; but these accounts, coming from the avowed enemies of the king, are scarcely to be credited; and perhaps *policy*, as well as inclination, might

N^o 190.

contribute somewhat to this scandalous behaviour, that he might thereby recommend himself to the libertines of Athens, and prevent even many of the more thinking part of the people from suspecting his designs. But in whatever excesses he might at times indulge himself, he never lost sight of his main object, the subjugation of the Greek states. On pretence of being in want of money to defray the expence of his buildings, he borrowed money at a very high price throughout the whole country; and this he found an easy matter to do, as the dissipation of the Delphic treasures had rendered cash very plentiful in Greece. Thus he attached his creditors firmly to his own interest; and on pretence of paying debts, was enabled without molestation to bestow a number of pensions and gratuities upon the Athenian orators, who by their treacherous harangues contributed greatly to the ruin of their country; at least as far as it could be ruined by subjection to a prince who would have obliged them to remain at peace, and apply themselves to useful arts. These he himself encouraged in a very eminent degree. The greatest part of his time was employed at Pella, which city he adorned in the most magnificent manner with temples, theatres, and porticoes. He invited, by liberal rewards, the most ingenious artists in Greece; and as many of these met with very little encouragement in their own country, great numbers flocked to him from all quarters. In the government of his people, also, Philip behaved with the utmost impartiality; listening with condescension to the complaints of the meanest of his subjects, and keeping up a constant correspondence with those whom he thought worthy of his acquaintance; from which, it is not easy to imagine how he could be so guilty of the vices we have already mentioned from some ancient historians.

The fate of Olynthus was now soon determined. This city, which held the balance of power betwixt Athens and Macedon, was taken and plundered, and the inhabitants sold for slaves; but the chief hope of Philip was in putting an end to the Phocian war. For this purpose he affected a neutrality, that he might thereby become the arbiter of Greece. His hopes were well founded; for the Thebans, who were at the head of the league against the Phocians, solicited him on the one side, and the states confederate with the Phocians did the like on the other. He answered neither, yet held both in dependence. In his heart he favoured the Thebans, or rather placed his hopes of favouring his own cause in that state; for he well knew, that the Athenians, Spartans, and other states allied with Phocis, would never allow him to pass Thermopylæ, and lead an army into their territories. So much respect, however, did he show to the ambassadors from these states, particularly Ctesiphon and Phrynon, who came from Athens, that they believed him to be in their interest, and reported as much to their masters. The Athenians, who were now dissolved in ease and luxury, re-⁵⁶ceived this news with great satisfaction; and named immediately ten plenipotentiaries to go and treat of a full and lasting peace with Philip. Among these plenipotentiaries were Demosthenes and Eëchines, the most celebrated orators in Athens. Philip gave directions that these ambassadors should be treated with the utmost civility; naming, at the same time, three of his

Macedon.

Over-Athenians, and at last concludes a peace.

Macedon.

his ministers to confer with them, viz. Antipater, Parmenio, and Eurylochus. Demosthenes being obliged to return to Athens, recommended it to his colleagues not to carry on their negotiations with Philip's deputies; but to proceed with all diligence to court, there to confer with the king himself. The ambassadors, however, were so far from following his instructions, that they suffered themselves to be put off for three months by the arts of Philip and his ministers.

In the mean time, the king took from the Athenians such places in Thrace as might best cover his frontiers; giving their plenipotentiaries, in their stead, abundance of fair promises, and the strongest assurances that his good-will should be as beneficial to them as ever their colonies had been. At last a peace was concluded; but then the ratification of it was deferred till Philip had possessed himself of Phœræa in Thessaly, and saw himself at the head of a numerous army: then he ratified the treaty; and dismissed the plenipotentiaries with assurances, that he would be ready at all times to give the Athenians proofs of his friendship. On their return to Athens, when this matter came to be debated before the people, Demosthenes plainly told them, that, in his opinion, the promises of Philip ought not to be relied on, because they appeared to be of little significance in themselves, and came from a prince of so much art, and so little fidelity, that they could derive no authority from their maker. *Æschines*, on the other hand, gave it as his sentiment, that the king of Macedonia's assurances ought to give them full satisfaction. He said, that for his part, he was not politician enough to see any thing of disguise or dissimulation in the king's conduct; that there was great danger in distrusting princes; and that the surest method of putting men upon deceit was to show that we suspected them of it. The rest of the plenipotentiaries concurred with *Æschines*; and the people, desirous of quiet, and addicted to pleasure, easily gave credit to all that was said, and decreed that the peace should be kept. All this was the easier brought about, because Phocion, the worthiest man in the republic, did not oppose Philip; which was owing to his having a just sense of the state his country was in. He conceived, that the Athenians of those times were nothing like their ancestors; and therefore, as he expressed himself on another occasion, he was desirous, since they would not be at the head of Greece themselves, that they would at least be upon good terms with that power which would be so.

Philip, who knew how to use as well as to procure opportunity, while the Athenians were in this good humour, passed Thermopyla, without their knowing whether he would fall on Phocis or Thebes; but he quickly deceived them, by commanding his soldiers to put on crowns of laurel, declaring them thereby the troops of Apollo, and himself the lieutenant-general of that god. He then entered Phocis with an air of triumph; which so terrified the Phocians, whom he had caused to be proclaimed sacrilegious persons, that they immediately dismissed all thoughts of defence, and without more ado submitted to his mercy. This the Phocian war, which had so long employed all Greece, was ended without a stroke; and the judgement on the Phocians remitted to the Amphictyons,

or grand council of Greece. By their decree the walls of three Phocian cities were demolished, the people were forbid to inhabit in any but villages, to pay a yearly tribute of 60 talents, and never to make use either of houses or arms till they had repaid to the temple of Apollo the money they had sacrilegiously carried from thence. Their arms were taken from them, broken to pieces, and burnt; their double voice in the council was taken from them, and given to the Macedonians. Other orders were made for settling the affairs both of religion and state throughout Greece: all of which were executed by Philip with great exactness and moderation, he paying the most profound respect to the council; and, when he had performed its commands, retiring peaceably with his army back to Macedonia, which gained him great reputation.

At Athens alone, the justice and piety of Philip was not understood. The people began to see, though a little too late, that they had been abused and deceived by those who had negotiated the late peace. They saw, that, through their acceptance of it, the Phocians were destroyed; that Philip was become master of the Thermopyla; and might enter Greece when he pleased; that, in abandoning their allies, they had abandoned themselves; and that, in all probability, they might soon feel the weight of his power, whom they had so foolishly trusted: they therefore began to take new and hostile measures; they ordered that the women should retire out of the villages into the city, their walls be repaired, and their forts new strengthened. They seemed inclined to question Philip's election into the council of the Amphictyons, because it had been done without their consent; and even to proceed to an open war. In all likelihood they had carried things to extravagancy, if Demosthenes had not interposed. He told them, that though he was not for making the peace, he was however for keeping it; and that he saw no manner of occasion for their entering into so unequal a contest as would needs ensue, if they took up arms, not only against Philip, but against all the states concurring with him in the late transactions. This seems to have cooled the rage of the Athenians; and to have brought them to think of ruining Philip by degrees, as by degrees they had raised him.

The same of his achievements without the bounds of Macedonia having disposed the subjects of Philip to conquests, he every thing from his conduct, and the several states of Greece to desire above all things his friendship; that prudent monarch laid hold of this favourable situation to fix his dominion on such a stable foundation as that a reverse of fortune should not immediately destroy it. To this end, while he carried on his negotiations through Greece, he likewise kept his army in exercise, by taking several places in Thrace, which terribly incommoded the Athenians. Diopithes, who had the government of the Athenian colonies in those parts, perceiving well what end Philip had in view, did not stay for instructions from home; but having raised with much expedition a considerable body of troops, taking advantage of the king's being absent with his army, entered the adjacent territories of Philip, and wasted them with fire and sword.

The king, who, on account of the operations of the

Macedon.

Is again
opposed by
the Athenians,

Pursues his
conquests
in Thrace.

Diopithes
dominates
invaded by
Diopithes.

57
Passes
Thermopyla, and
ends the
Phocian
war.

Macedon.

campaign in the Cheroneſe, was not at leiſure to reſpect Diopithes by force, nor indeed could divide his army without imminent hazard, choſe, like an able general, rather to abandon his provinces to inſults, which might be afterwards revenged, than, by following the dictates of an ill-timed paſſion, to hazard the loſs of his veteran army, whereon lay all his hopes. He contented himſelf, therefore, with complaining to the Athenians of Diopithes's conduct, who in a time of peace had entered his dominions, and committed ſuch deſolations as could ſcarce have been juſtified in a time of war. His partisans ſupported this application with all their eloquence. They told the Athenians, that unleſs they recalled Diopithes, and brought him to a trial for this infringement of the peace, they ought not to hope either for the friendſhip of Philip or of any other prince or ſtate; neither could they juſtly complain, if, prompted by ſuch a precedent, others ſhould break faith with them, and fall without the leaſt notice upon their dominions. Demotheſes defended Diopithes; and undertook to ſhow that he deſerved the praiſe and not the cenſure of the Athenians. Thoſe of the other party began then to charge him with crimes of a different nature; they alleged, that he oppreſſed the ſubjects and maltreated the allies of Athens. Demotheſes replied, that of theſe things there were as yet no proofs; that when ſuch ſhould appear, a ſingle galley might be ſent to bring over Diopithes to abide their judgment, but that Philip would not come if they ſent a fleet; whence he inferred, that they ought to be cautious, and to weigh well the merits of this cauſe before they took any reſolution. He ſaid, that it was true Philip had not as yet attacked Attica, or pretended to make a deſcent on their territories in Greece, or to force his way into their ports; when it came to that, he was of opinion they would be hardly able to defend themſelves; wherefore he thought ſuch men were to be eſteemed as fought to protect their frontiers, in order to keep Philip as long as might be at a diſtance: whereupon he moved, that, inſtead of diſowning what Diopithes had done, or dreſſing him to diſmiſs his army, they ſhould ſend him over recruits, and ſhow the king of Macedon they knew how to protect their territories, and to maintain the dignity of their ſtate, as well as their anceſtors. Theſe arguments had ſuch an effect, that a decree was made conformable to his motion.

*While affairs ſtood thus, the Illyrians recovering courage, and ſeeing Philip at ſuch a diſtance, haraſſed the frontiers of Macedon, and threatened a formidable invaſion: but Philip, by quick marches, arrived on the borders of Illyrium; and ſtruck this barbarous people with ſuch a panic, that they were glad to compound for their former depredations at the price he was pleaſed to ſet. Moſt of the Greek cities in Thrace now ſought the friendſhip of the king, and entered into a league with him for their mutual defence. As it cannot be ſuppoſed, that each of theſe free cities had a power equal to that of Philip, we may therefore look upon him as their protector. About this time Philip's negotiations in Peloponneſus began to come to light; the Argives and Meſſenians, growing weary of that tyrannical authority which the Spartans exerciſed over them, applied to Thebes for aſſiſtance; and the Thebans, out of their natural averſion to Sparta, fought

to open a paſſage for Philip into Peloponneſus, that, in conjunction with them, he might humble the Lacedæmonians. Philip readily accepted the offer; and reſolved to procure a decree from the Amphiſtyons, directing the Lacedæmonians to leave Argos and Meſſene free; which if they complied not with, he, as the lieutenant of the Amphiſtyons might, with great appearance of juſtice, march with a body of troops to enforce their order. When Sparta had intelligence of this, ſhe immediately applied to Athens, earneſtly intreating aſſiſtance, as in the common cauſe of Greece. The Argives and Meſſenians, on the other hand, laboured aſſiduouſly to gain the Athenians to their ſide; alleging that, if they were friends to liberty, they ought to aſſiſt thoſe whoſe only aim was to be free. Demotheſes, at this juncture, outwitted Philip, if we may borrow that king's expreſſion: for, by a vehement harangue, he not only determined his own citizens to become the avowed enemies of the king, but alſo made the Argives and Meſſenians not over fond of him for an ally; which when Philip perceived, he laid aſide all thoughts of this enterpriſe for the preſent, and began to praſtice in Eubœa.

This country, now called *Negropont*, is ſeparated from Greece by the Euripus, a ſtrait ſo narrow, that Eubœa might eaſily be united to the continent. This ſituation made Philip call it *the fetters of Greece*; which he therefore fought to have in his own hands. There had been for ſome years great diſturbances in that country; under colour of which, Philip ſent forces thither, and deſtroyed Porthmos, the ſtrongeſt city in thoſe parts, leaving the country under the government of three lords, whom Demotheſes roundly calls *tyrants* eſtabliſhed by Philip. Shortly after, the Macedonians took Oreus, which was left under the government of five magiſtrates, ſtyled alſo *tyrants* at Athens. Thither Plutarch of Eretria, one of the moſt eminent perſons in Eubœa, went to represent the diſtreſſes of his country, and to implore the Athenians to ſet it free. This ſuit Demotheſes recommended warmly to the people; who ſent thither their famous leader Phocion, ſupported by formidable votes, but a very ſlender army: yet ſo well did he manage the affairs of the commonwealth and her allies, that Philip quickly found he muſt for a time abandon that project; which, however, he did not till he had formed another no leſs beneficial to himſelf, or leſs dangerous to Athens. It was, the proſecution of his conqueſts in Thrace, which he thought of puſhing much farther than he had hitherto done, or could be reaſonably ſuſpected to have any intention of doing.

Extraordinary preparations were made by the Macedonian monarch for this campaign. His ſon Alexander was left regent of the kingdom; and he himſelf with 30,000 men laid ſiege to Perinthus, one of the ſtrongeſt cities in the country. At preſent, however, all his arts of cajoling and pretending friendſhip were inſufficient to deceive the Athenians. They gave the command of their army and fleet to Phocion; a general of great abilities, and with whom Philip would have found it very hard to contend. On the other hand, the king of Perſia began to turn jealous of the growing power of the Macedonian monarch. The Perſian kings had been accuſtomed to regard thoſe of Macedon as their faithful allies; but the good fortune

Macedon.

68
Who is de-
fended by
Demosithe-
ses.

69
Philip's
schemes de-
ſeated.

Macedon. of Philip, the continual clamour of the Athenians against him, and his dethroning at pleasure the petty princes of Thrace, made him now regarded in another light. When therefore he led his troops against Periklus, the Great King, as he was styled by the Greeks, sent his letters mandatory to the governors of the maritime provinces, directing them to supply the place with all things in their power; in consequence of which they filled it with troops, granted subsidies in ready money, and sent besides great convoys of provision and ammunition. The Byzantines also, supposing their own turn would be next, exerted their utmost endeavours for the preservation of Perinthus; sending thither the flower of their youth, with all other necessaries for an obdurate defence. The consequence of all this was, that Philip found himself obliged to raise the siege with great loss.

63
How he at last gained his point.

That the reputation of the Macedonian army might not sink by this disgrace, Philip made war on the Scythians and Triballi, both of whom he defeated; and then formed a design of invading Attica, though he had no fleet to transport his troops, and knew very well that the Thebans were not to be depended upon if he attempted to march through the Pise, and that the Thebans would even then be ready to oppose his march. To obviate all these difficulties, he had recourse to Athens itself; where, by means of his partisans, he procured his old friend Æschines to be sent their deputy to the Amphictyons. This seemed a small matter, and yet was the hinge on which his whole project turned. By that time Æschines had taken his seat, a question was stirred in the council, whether the Locrians of Amphissa had not been guilty of sacrilege in ploughing the fields of Cyrria in the neighbourhood of the temple of Delphi. The assembly being divided in their opinions, Æschines proposed to take a view; which was accordingly decreed. But when the Amphictyons came in order to see how things stood, the Locrians, either jealous of their property, or spurred thereto by the suggestions of some who saw farther than themselves, fell upon those venerable persons so rudely, that they were compelled to secure themselves by flight. The Amphictyons decreed, that an army should be raised, under the command of one of their own number, to chastise the delinquents; but as this army was to be composed of troops sent from all parts of Greece, the appearance at the rendezvous was so inconsiderable, that the Amphictyons sent to command them durst undertake nothing. The whole matter being reported to the council, Æschines, in a long and eloquent harangue, showed how much the welfare and even the safety of Greece depended on the defence paid to their decrees; and after inveighing against the want of public spirit in such as had not sent their quotas at the time appointed by the council, he moved that they should elect Philip for their general, and pray him to execute their decree. The deputies from the other states, conceiving that by this expedient their respective constituents would be free from any farther trouble or expence, came into it at once; whereupon a decree was immediately drawn up, purporting that ambassadors should be sent to Philip of Macedon, in the name of Apollo and the Amphictyons, once more to require his assistance, and to notify to him, that the states of Greece had unanimously

chosen him their general, with full power to act as he thought fit against such as had opposed the authority of the Amphictyons. Thus of a sudden Philip acquired all that he fought; and having an army ready in expectation of this event, he immediately marched to execute the commands of the Amphictyons in appearance, but in reality to accomplish his own designs. For having passed into Greece with his army, instead of attacking the Locrians, he seized immediately upon Elatea a great city of Phocis upon the river Cephissus.

The Athenians in the mean time were in the utmost confusion on the news of Philip's march. However, by the advice of Demosthenes, they invited the Thebans to join them against the common enemy of Greece. Philip endeavoured as much as possible to prevent this confederacy from taking place; but all his efforts proved ineffectual. The Athenians raised an army, which marched immediately to Eleusis, where they were joined by the Thebans. The confederates made the best appearance that had ever been seen in Greece, and the troops were exceedingly good; but unfortunately the generals were men of no conduct or skill in the military art. An engagement ensued at Cheronea; where, in Alexander commanded one wing of the Macedonian army, and his father Philip the other. The confederate army was divided according to the different nations of which it consisted; the Athenians having the right and the Boeotians the left. In the beginning of the battle the confederates had the better; whereupon Stratocles an Athenian commander cried out, "Come on, brother soldiers, let us drive them back to Macedon;" which being overheard by the king, he said very coolly to one of his officers, "These Athenians do not know how to conquer." Upon this he directed the files of the phalanx to be straitened; and drawing his men up very close, retired to a neighbouring eminence: from whence, when the Athenians were eager in their pursuit, he rushed down with impetuosity, broke, and routed them with prodigious slaughter. The orator Demosthenes behaved very unbecomingly in this engagement; for he deserted his post, and was one of the first that fled: nay, we are told, that a slave catching hold of his robe, he, not doubting but it was an enemy, cried out, "Alas! spare my life."

This victory determined the fate of Greece; and from this time we must reckon Philip supreme lord of general all the Grecian states. The first use he made of his power was to convoke a general assembly, wherein he was recognised generalissimo, and with full power appointed their leader against the Persians. Having, by virtue of his authority, settled a general peace among them, and appointed the quota that each of the states should furnish for the war, he dismissed them; and returning to Macedon, began to make great preparations for this new expedition. His pretence for making war on the Persians at this time was the assistance given by the Persians to the city of Perinthus, as already mentioned. In the mean time, however, the king, by reason of the dissensions which reigned in his family, was made quite miserable. He quarrelled with his wife Olympias to such a degree, that he divorced her, and married another woman named Cleopatra. This produced a quarrel between him and his son Alexander;

Macedon.

alexander; which also came to such an height, that Alexander retired into Epirus with his mother. Some time afterwards, however, he was recalled, and a reconciliation took place in appearance; but in the mean time a conspiracy was formed against the king's life, the circumstances and causes of which are very much unknown. Certain it is, however, that it took effect, as the king was exhibiting certain shows in honour of his daughter's marriage with the king of Epirus. Philip, having given a public audience to the ambassadors of Greece, went next day in state to the theatre. All the seats were early taken up; and the shows began with a splendid procession, wherein the images of the 12 superior deities of Greece were carried, as also the image of Philip, habited in like manner, as if he now made the 13th, at which the people shouted aloud: Then came the king alone, in a white robe, crowned, with his guards at a considerable distance, that the Greeks might see he placed his safety only in his confidence of the loyalty of his subjects. Pausanias, the assassin, however, had fixed himself close by the door of the theatre; and observing that all things fell out as he had foreseen they would, took his opportunity when the king drew near him, and plunging his sword in his left side, laid him dead at his feet. He then fled as fast as he was able towards the place where his horses were; and would have escaped, had not the twig of a vine caught his shoe and thrown him down. This gave time to those who pursued him to come up with him; but instead of securing him, in order to extort a discovery of his accomplices, they put an end to his life.

69.
Is murdered.69.
His character.

With regard to the character of this monarch, it appears certain, that he was one of the most eminent persons that ever sat on a throne. Had he lived for some time longer, he would in all probability have subdued the Persians; which was in truth less difficult than what he had already done. "Had that event taken place (says Dr Gillies), the undertakings of his long and successful reign would have been ennobled and illuminated by the splendor of extensive foreign conquest. Philip would have reached the height of such renown as is obtained by the habits of activity, vigilance, and fortitude, in the pursuit of unbounded greatness; and in the opinion of posterity, would perhaps have surpassed the glory of all kings and conquerors who either preceded or followed him. Yet, even on this supposition, there is not any man of sense and probity, who, if he allows himself time for serious reflection, would purchase the imagined grandeur and prosperity of the king of Macedon at the price of his artifices and his crimes; and to a philosopher, who considered either the means by which he had obtained his triumphs or the probable consequences of his dominion over Greece and Asia, the busy ambition of this mighty conqueror would appear but a deceitful scene of splendid misery."

70.
Extravagant joy
of the
Athenians.

No sooner did the news of Philip's death reach Athens, than, as if all danger had been past, the inhabitants showed the most extravagant signs of joy. Demosthenes and his party put on chaplets of flowers, and behaved as if they had gained a great victory. Phocion reproved them for this madness; bidding them remember, that "the army which had beaten them at Cheronæa was lessened but by one." This reproof,

however, had very little effect. The people heard with pleasure all the harsh things which the orators could say of the young Alexander king of Macedon, whom they represented as a giddy wrong-headed boy, ready to grasp all things in his imagination, and able to perform nothing. The affairs of Macedon indeed were in a very distracted state on the accession of Alexander; for all the neighbouring nations had the same notion of the young king with the Athenians; and being irritated by the usurpations of Philip, immediately revolted; and the states of Greece entered into a confederacy against him. The Persians had been contriving to transfer the war into Macedon; but as soon as the news of Philip's death reached them, they behaved as if all danger had been over. At the same time Attalus, one of the Macedonian commanders, aspired to the crown, and fought to draw off the soldiers from their allegiance.

In the councils held on this occasion, Alexander's best friends advised him rather to make use of dissimulation than force, and to cajole those whom they thought he could not subdue. These advices, however, were ill-suited to the temper of their monarch. He thought that vigorous measures only were proper, and therefore immediately led his army into Thessaly. Here he harangued the princes so effectually, that he thoroughly gained them over to his interest, and was by them declared general of Greece; upon which he returned to Macedon, where he caused Attalus to be seized and put to death.

In the spring of the next year (335 B. C.) Alexander resolved to subdue the Triballians and Illyrians, who inhabited the countries now called *Bulgaria* and *Scalvania*, and had been very formidable enemies to the Macedonian power. In this expedition he discovered, though then but 20 years of age, a surprising degree of military knowledge. Having advanced to the passes of Mount Hæmus, he found that the barbarians had posted themselves in the most advantageous manner. On the tops of the cliffs, and at the head of every passage, they had placed their carriages and wagons in such a manner as to form a kind of parapet with their shafts inwards, that when the Macedonians should have half ascended the rock, they might be able to push these heavy carriages down upon them. They reckoned the more upon this contrivance, because of the close order of the phalanx, which, they imagined, would be terribly exposed by the soldiers wanting room to stir, and thereby avoid the falling wagons: But Alexander, having directed his heavy-armed troops to march, gave orders, that, where the way would permit, they should open to the right and left, and suffer the carriages to go through; but that, in the narrow passes, they should throw themselves on their faces with their shields behind them, that the carts might run over them. This had the desired effect; and the Macedonians reached the enemies' works without the loss of a man. The dispute was then quickly decided; the barbarians were driven from their posts with great slaughter, and left behind them a considerable booty for the conquerors.

The next exploits of Alexander were against the Gætæ, the Tanlantii, and some other nations inhabiting the country on the other side of the Danube. Them he also overcame; showing in all his actions the

Macedon.

71.
Alexander declared
general of
Greece.72.
Defeats the
Triballians.

Macedon.

the most perfect skill in military affairs, joined with the greatest valour. In the mean time, however, all Greece was in commotion by a report which had been confidently spread abroad, that the king was dead in Illyria. The Thebans, on this news, seized Amyntas and Timolaus, two eminent officers in the Macedonian garrison which held their citadel, and dragged them to the market-place, where they were put to death without either form or process, or any crime alleged against them. Alexander, however, did not suffer them to remain long in their mistake. He marched with such expedition, that in seven days he reached Pallene in Thessaly; and in six days more he entered Borotia, before the Thebans had any intelligence of his passing the straits of Thermopylae. Even then they would not believe that the king was alive; but insisted that the Macedonian army was commanded by Antipater, or by one Alexander the son of Eropus. The rest of the Greeks, however, were not so hard of belief; and therefore sent no assistance to the Thebans, who were thus obliged to bear the consequences of their own folly and obstinacy. The city was taken by storm, and the inhabitants were for some hours massacred without distinction of age or sex; after which the houses were demolished, all except that of Pindar the famous poet, which was spared out of respect to the merit of its owner, and because he had celebrated Alexander I. king of Macedon. The lands, excepting those destined to religious uses, were shared among the soldiers, and all the prisoners sold for slaves; by which 440 talents were brought into the king's treasury.

73
The Thebans revolt on the news of his death.

74
Thebes taken and destroyed.

By this severity the rest of the Grecian states were so thoroughly humbled, that they thought no more of making any resistance, and Alexander had nothing further to hinder him from his favourite project of invading Asia. Very little preparation was necessary for the Macedonian monarch, who went out as to an assured conquest, and reckoned upon being supplied only by the spoils of his enemies. Historians are not agreed as to the number of his army: Arrian says, that there were 30,000 foot and 5000 horse. Diodorus Siculus tells us, that there were 13,000 Macedonian foot, 7000 of the confederate states, and 5000 mercenaries. These were under the command of Parmenio. Of the Odrysians, Triballians, and Illyrians, there were 5000; and of the Agrians, who were armed only with darts, 1000. As for the horse, he tells us there were 18,000 commanded by Philotas, and as many Thessalians under the command of Callos: out of the confederate states of Greece, were 600 commanded by Eurygius; and 900 Thracians and Peonians, who led the van under Cassander. Plutarch tells us, that, according to a low computation, he had 30,000 foot and 5000 horse; and, according to the largest reckoning, he had 34,000 foot and 4000 horse. As to his fund for the payment of the army, Aristobolus says it was but 70 talents; and Onesicritus, who was also in this expedition, not only takes away the 70 talents; but affirms that the king was 200 in debt. As for provisions, there was just sufficient for a month, and no more; and to prevent disturbances, Antipater was left in Macedonia with 12,000 foot and 1000 horse.

96
Set out on his expedition.

The army having assembled at Amphipolis, he marched from thence to the mouths of the river Strymon; then crossing mount Pangæus, he took the road

to Abdera. Crossing the river Eubrus, he proceeded through the country of Pædis, and in 20 days reached Sestos; thence he came to Eleus, where he sacrificed on the tomb of Proteusilaus, because he was the first among the Greeks who at the siege of Troy set foot on the Asiatic shore. He did this, that his landing might be more propitious than that of the hero to whom he sacrificed, who was slain soon after. The greatest part of the army, under the command of Parmenio, embarked at Sestos, on board a fleet of 160 galleys of three benches of oars, besides small craft. Alexander himself sailed from Eleus; and when he was in the middle of the Hellespont, offered a bull to Neptune and the Nereids, pouring forth at the same time a libation from a golden cup. When he drew near the shore, he lanced a javelin, which stuck in the earth; then, in complete armour, he leaped upon the strand; and having erected altars to Jupiter, Minerva, and Hercules, he proceeded to Ilium. Here again he sacrificed to Minerva; and taking down some arms which had hung in the temple of that goddess since the time of the Trojan war, consecrated his own in their stead. He sacrificed also to the ghost of Priam, to avert his wrath on account of the desecration which he himself claimed from Achilles.

Macedon.

In the mean time the Persians had assembled a great army in Phrygia; among whom was one Memnon a Rhodian, the best officer in the service of Darius. Alexander, as soon as he had performed all the ceremonies which he judged necessary, marched directly towards the enemy. Memnon gave it as his opinion, that they should burn and destroy all the country round, that they might deprive the Greeks of the means of subsisting, and then transport a part of their army into Macedon. But the Persians, depending on their cavalry, rejected this salutary advice; and posted themselves along the river Granicus, in order to wait the arrival of Alexander. In the engagement which happened on the banks of that river, the Persians were defeated; and Alexander became master of all the neighbouring country; which he immediately began to take care of, as if it had been part of his hereditary dominions. The city of Sardis was immediately delivered up; and here Alexander built a temple to Jupiter Olympius. After this, he restored the Ephesians to their liberty; ordered the tribute which they formerly paid to the Persians to be applied towards the rebuilding of the magnificent temple of Diana; and having settled the affairs of the city, marched against Miletus. This place was defended by Memnon with a considerable body of troops who had fled thither after the battle of Granicus, and therefore made a vigorous resistance. The fortune of Alexander, however, prevailed; and the city was soon reduced, though Memnon with part of the troops escaped to Halicarnassus. After this, the king dismissed his fleet, for which various reasons have been assigned; though it is probable that the chief one was to show his army that their only resource now was in subverting the Persian empire.

See Cræsus.

77
Consequence of his first victory.

Almost all the cities between Miletus and Halicarnassus submitted as soon as they heard that the former was taken; but Halicarnassus, where Memnon commanded with a very numerous garrison, made an obstinate defence. Nothing, however, was able to resist the

Macedon. the Macedonian army. Memnon was at last obliged to abandon the place; upon which Alexander took and rased the city of Tralles in Phrygia; received the submission of several princes tributary to the Persians; and having destroyed the Marmarians, a people of Lydia who had fallen upon the rear of his army, put an end to the campaign; after which he sent home all the new-married men; in obedience, it would seem, to a precept of the Mosaic law, and which endeared him more to his soldiers than any other action of his life.

As soon as the season would permit, Alexander quitted the province of Phaeidus; and having sent part of his army through the mountainous country to Perga, by a short but difficult road, took his route by a certain promontory, where the way is altogether impassable, except when the north winds blow. At the time of the king's march the south wind had held for a long time; but of a sudden it changed, and blew from the north so violently, that, as he and his followers declared, they obtained a safe and easy passage through the Divine assistance. By many this march is held to be miraculous, and compared to that of the children of Israel through the Red Sea; while, on the other hand, it is the opinion of others, that there was nothing at all extraordinary in it. He continued his march towards Gordium, a city of Phrygia; the enemy having abandoned the strong pass of Telmissus, through which it was necessary for him to march. When he arrived at Gordium, and found himself under a necessity of staying some time there till the several corps of his army could be united, he expressed a strong desire of seeing Gordius's chariot, and the famous knot in the harness, of which such strange stories had been published to the world. The cord in which this knot was tied, was made of the inner rind of the cornel-tree; and no eye could perceive where it had begun or ended. Alexander, when he could find no possible way of untying it, and yet was unwilling to leave it tied lest it should cause some fears in the breasts of his soldiers, is said by some authors to have cut the cords with his sword, saying, "It matters not how it is undone." But Aristobolus assures us, that the king wrested a wooden pin out of the beam of the waggon, which, being driven in across the beam, held it up; and so took the yoke from under it. Be this as it will, however, Arrian informs us, that a great tempest of thunder, lightning, and rain, happening the succeeding night, it was held declarative of the true solution of this knot, and that Alexander should become lord of Asia.

The king having left Gordium, marched towards Cilicia; where he was attended with his usual good fortune, the Persians abandoning all the strong passes as he advanced. As soon as he entered the province, he received advice that Artabanes, whom Darius had made governor of Tarsus, was about to abandon it, and that the inhabitants were very apprehensive that he intended to plunder them before he withdrew. To prevent this, the king marched incessantly, and arrived just in time to save the city. But his saving it had well nigh cost him his life: for, either through the excessive fatigue of marching, as some say, or, according to others, by his plunging when very hot into the river Cydnus, which, as it runs through thick shades,

has its waters excessively cold, he fell into such a distemper as threatened his immediate dissolution. His army lost their spirits immediately; the generals knew not what to do; and his physicians were so much affrighted, that the terror of his death hindered them from using the necessary methods for preserving his life. Philip the Acarnanian alone preserved temper enough to examine the nature of the king's distemper; the worst symptom of which was a continual waking, and which he took off by means of a potion, and in a short time the king recovered his usual health.

Soon after Alexander's recovery, he received the agreeable news that Ptolemy and Afander had defeated the Persian generals, and made great conquests on the Hellespont; a little after that, he met the Persian army at Issus, commanded by Darius himself. A bloody engagement ensued, in which the Persians were defeated with great slaughter, as related under the article Issus. The consequences of this victory were very advantageous to the Macedonians. Many governors of provinces and petty princes submitted themselves to the conqueror; and such as did so were treated, not as a newly-conquered people, but as his old hereditary subjects; being neither burthened with soldiers nor oppressed with tribute. Among the number of those places which, within a short space after the battle of Issus, sent deputies to submit to the conqueror, was the city of Tyre. The king, whose name was Azelmicus, was absent in the Persian fleet; but his son was among the deputies, and was very favourably received by Alexander. The king probably intended to confer particular honours on the city of Tyre; for he acquainted the inhabitants that he would come and sacrifice to the Tyrian Hercules, the patron of their city, to whom they had erected a most magnificent temple. But these people, like most other trading nations, were too suspicious to think of admitting such an enterprising prince with his troops within their walls. They sent therefore their deputies again to him, to inform him, that they were ready to do whatever he should command them; but, as to his coming and sacrificing in their city, they could not consent to that, but were positively determined not to admit a single Macedonian within their gates. Alexander immediately dismissed their deputies in great displeasure. He then assembled a council of war, wherein he insisted strongly on the disaffected state of Greece, (for most of the Grecian states had sent ambassadors to Darius, to enter into a league with him against the Macedonians), the power of the Persians by sea, and the folly of carrying on the war in distant provinces, while Tyre was left unreduced behind them: he also remarked, that if once this city was subdued, the sovereignty of the sea would be transferred to them, because it would fix their possession of the coasts; and as the Persian fleet was composed chiefly of tributary squadrons, those tributaries would fight the battles, not of their late but of their present masters. For these reasons the siege of Tyre was resolved on. The town was not taken, however, without great diffi-

culty; which provoked Alexander to such a degree, that he treated the inhabitants with the greatest cruelty. See TYRE.

After the reduction of Tyre, Alexander, though the season was already far advanced, resolved to make

Macedon.

78
Writes the
Gordian
knot.

79
His sick-
ness and re-
covery.

80
The Tyre taken
and de-
stroyed.

Macedon. an expedition into Syria; and in his way thither proposed to chastise the Jews, who had highly offended him during the siege of Tyre: for when he sent to them to demand provisions for his soldiers, they answered, That they were the subjects of Darius, and bound by oath not to supply his enemies. The king, however, was pacified by their submission; and not only pardoned them, but conferred many privileges upon them, as related under the article Jews.

81
Egypt sub-
mits.

From Jerusalem Alexander marched directly to Gaza, the only place in that part of the world which still held out for Darius. This was a very large and strong city, situated on an high hill, about five miles from the sea-shore. One *Batis*, an eunuch, had the government of the place; and had made every preparation necessary for sustaining a long and obstinate siege. The governor defended the place with great valour, and several times repulsed his enemies: but at last it was taken by storm, and all the garrison slain to a man; and this secured to Alexander an entrance into Egypt, which having before been very impatient of the Persian yoke, admitted the Macedonians peaceably.

82
Alexander
visits the
temple of
Jupiter
Ammon.

Here the king laid the foundations of the city of Alexandria, which for many years after continued to be the capital of the country. While he remained here, he also formed the extraordinary design of visiting the temple of Jupiter Ammon. As to the motives by which he was induced to take this extraordinary journey, authors are not agreed; but certain it is, that he hazarded himself and his troops in the highest degree; there being two dangers in this march, which, with the example of Cambyfes, who lost the greatest part of his army in it, might have terrified any body but Alexander. The first was the want of water, which, in the sandy deserts surrounding the temple, is no where to be found; the other, the uncertainty of the road from the fluctuation of the sands; which changing their situation every moment, leave the traveller neither a road to walk in nor mark to march by. These difficulties, however, Alexander got over; though not without a miraculous interposition, as is pretended by all his historians.

Alexander having consulted the oracle, and received a favourable answer, returned to pursue his conquests. Having settled the government of Egypt, he appointed the general rendezvous of his forces at Tyre. Here he met with ambassadors from Athens, requesting him to pardon such of their countrymen as he found serving the enemy. The king, being desirous to oblige such a famous state, granted their request; and sent also a fleet to the coast of Greece, to prevent the effects of some commotions which had lately happened in Peloponnesus. He then directed his march to Thapfacus; and having passed the Euphrates and Tigris, met with Darius near Arbela, where the Persians were again overthrown with prodigious slaughter, and Alexander in effect became master of the Persian empire.

4 See Ar-
bela.

83
Reduces
Babylon,
Susa, and
Persepolis.

After this important victory, Alexander marched directly to Babylon, which was immediately delivered up; the inhabitants being greatly disaffected to the Persian interest. After 30 days stay in this country, the king marched to Susa, which had already surrendered to Philoxenus, and here he received the treasures of the Persian monarch, amounting, according to the most generally received account, to 50,000 ta-

lents. Having received also at this time a supply of 6000 foot and 500 horse from Macedon, he set about reducing the nations of Media, among whom Darius was retired. He first reduced the *Urians*; and having forced a passage to Persepolis the capital of the empire, he like a barbarian destroyed the stately palace there, a pile of building not to be equalled in any part of the world; after having given up the city to be plundered by his soldiers. In the palace he found 120,000 talents, which he appropriated to his own use, and caused immediately to be carried away upon mules and camels; for he had such an extreme aversion to the inhabitants of Persepolis, that he determined to leave nothing valuable in the city.

During the time that Alexander remained at Persepolis, he received intelligence that Darius remained at Ecбатана the capital of Media; upon which he pursued him with the greatest expedition, marching at the rate of near 40 miles a-day. In 15 days he reached Ecбатана, where he was informed that Darius had retired from thence five days before, with an intent to pass into the remotest provinces of his empire. This put some stop to the rapid progress of the Macedonian army; and the king perceiving that there was no necessity for hurrying himself and his soldiers in such a manner, began to give the orders requisite in the present situation of his affairs. The *Thessalian* horse, who had deserved exceedingly well of him in all his battles, he dismissed according to his agreement; gave them their whole pay, and ordered 2000 talents over and above to be distributed among them. He then declared that he would force no man: but if any were willing to serve him longer for pay, he desired they would enter their names in a book, which a great many of them did; the rest sold their horses, and prepared for their departure. The king appointed Epocillus to conduct them to the sea, and assigned him a body of horse as an escort: he likewise sent Menetes with them, to take care of their embarkation, and that they were safely landed in Eubœa without any expense to themselves.

84
He pursued
Darius.

On receiving fresh information concerning the state of Darius's affairs, the king set out again in pursuit of him, advancing as far as Rhages, a city one day's journey from the Caspian straits: there he understood that Darius had passed those straits some time before, which information leaving him again without hopes, he halted for five days. Oxidates, a Persian whom Darius had left prisoner at Susa, was made governor of Media, while the king departed on an expedition into Parthia. The Caspian straits he passed immediately without opposition; and then gave directions to his officers to collect a quantity of provisions sufficient to serve his army on a long march through a wasted country. But before his officers could accomplish those commands, the king received intelligence that Darius had been murdered by Bessus, one of his own subjects, and governor of Bactria, as is related at length under the article PERSIA.

85
Who is
murdered.

As soon as Alexander had collected his forces together, and settled the government of Parthia, he entered Hyrcania; and having, according to his usual custom, committed the greatest part of his army to the care of Craterus, he, at the head of a choice body of troops, passed through certain craggy roads, and

86
Alexander
reduces
Hyrcania.

Macedon.

and before the arrival of Craterus, who took an open and easy path, struck the whole provinces with such terror, that all the principal places were immediately put into his hands, and soon after the province of Aria also submitted, and the king continued Satibarzanes the governor in his employment.—The reduction of this province finished the conquest of Persia; but the ambition of Alexander to become master of every nation of which he had the least intelligence, induced him to enter the country of the *Mardi*, merely because its rocks and barrenness had hitherto hindered any body from conquering, or indeed from attempting to conquer it. This conquest, however, he easily accomplished, and obliged the whole nation to submit to his pleasure. But in the mean time disturbances began to arise in Alexander's new empire, and among his troops, which all his activity could not thoroughly suppress. He had scarcely left the province of Aria, when he received intelligence, that the traitor Bessus had caused himself to be proclaimed king of Asia by the name of *Artaxerxes*; and that Satibarzanes had joined him, after having massacred all the Macedonians who had been left in the province. Alexander appointed one *Arfanes* governor in the room of Satibarzanes; and marched thence with his army against the *Zarange*, who under the command of Barzaentes, one of those who had conspired against Darius, had taken up arms, and threatened to make an obstinate defence. But their numbers daily falling off, Barzaentes being afraid they would purchase their own safety at the expence of his, privately withdrew from his camp, and, crossing the river Indus, sought shelter among the nations beyond it. But they, either dreading the power of Alexander, or detesting the treachery of this Persian towards his former master, seized and delivered him up to Alexander, who caused him immediately to be put to death.

87
The Macedonians
gave them-
selves up to
luxury.

The immense treasure which the Macedonians had acquired in the conquest of Persia began now to corrupt them. The king himself was of a most generous disposition, and liberally bestowed his gifts on those around him; but they made a bad use of his bounty, and foolishly indulged in those vices by which the former possessors of that wealth had lost it. The king did all in his power to discourage the lazy and inactive pride which now began to show itself among his officers; but neither his discourses nor his example had any considerable effect. The manners of his courtiers from bad became worse, in spite of all he could say or do to prevent it; and at last they proceeded to censure his conduct, and to express themselves with some bitterness on the subject of his long continuance of the war, and his leading them constantly from one labour to another. This came to such an height, that the king was at last obliged to use some severity in order to keep his army within the limits of their duty. From this time forward, however, Alexander himself began to alter his conduct; and by giving a little into the customs of the Orientals, endeavoured to secure that obedience from his new subjects which he found so difficult to be preserved among his old ones. He likewise endeavoured, by various methods, to blend the customs of the Asiatics and the Greeks. The form of his civil government resembled that of the ancient Persian kings: in the military affairs, how-

Nº 190.

88
Alexander
conforms to
the Persian
customs.

ever, he preserved the Macedonian discipline; but then he made choice of 30,000 boys out of the provinces, whom he caused to be instructed in the Greek language, and directed to be brought up in such a manner as that from time to time he might with them fill up the phalanx. The Macedonians saw with great concern these extraordinary measures, which suited very ill with their gross understandings; for they thought, after all the victories they had gained, to be absolute lords of Asia, and to possess not only the riches of its inhabitants, but to rule the inhabitants themselves: whereas they now saw, that Alexander meant no such thing; but that, on the contrary, he conferred governments, offices at court, and all other marks of confidence and favour, indiscriminately both on Greeks and Persians.—From this time also the king seems to have given instances of a cruelty he had never shown before. Philotas his most intimate friend was seized, tortured, and put to death for a conspiracy of which it could never be proved that he was guilty; and soon after Parmenio and some others were executed without any crime at all real or alleged. These things very much disturbed the army. Some of them wrote home to Macedonia of the king's suspicions of his friends, and his disposition to hunt out enemies at the very extremities of the world. Alexander having intercepted some of these letters, and procured the best information he could concerning their authors, picked out these dissatisfied people, and having disposed them into one corps, gave it the title of the *turbulent battalion*; hoping by this means to prevent the spirit of disaffection from pervading the whole army.

As a farther precaution against any future conspiracy, Alexander thought fit to appoint Hephæstion and Clytus generals of the auxiliary horse; being apprehensive, that if this authority was lodged in the hands of a single person, it might prompt him to dangerous undertakings, and at the same time furnish him with the means of carrying them into execution. To keep his forces in action, he suddenly marched into the country of the *Euergetæ*, i. e. *Benefactors*; and found them full of that kind and hospitable disposition for which that name had been bestowed on their ancestors: he therefore treated them with great respect; and at his departure added some lands to their dominions, which lay contiguous, and which for that reason they had requested of him.

Turning then to the east, he entered Arachofia, the inhabitants of which submitted without giving him any trouble. While he passed the winter in these parts, the king received advice, that the *Arians*, whom he had so lately subdued, were again up in arms, Satibarzanes being returned into that country with two thousand horse assigned him by Bessus. Alexander instantly dispatched Artabazus the Persian, with Erigyus and Caranus, two of his commanders, with a considerable body of horse and foot: he likewise ordered Phrataphernes, to whom he had given the government of Parthia, to accompany them. A gene-Satibarzal engagement ensued, wherein the *Arians* behaved very well, as long as their commander Satibarzanes lived; but he engaging Erigyus, the Macedonian struck him first into the throat, and then, drawing forth his spear again, through the mouth; so that he immediately

Macedon.

89

⁹⁰ Macedon. immediately expired, and with him the courage of his soldiers, who instantly began to fly; whereupon Alexander's commanders made an easy conquest of the rest of the country, and settled it effectually under his obedience.

The king, notwithstanding the inclemency of the season, advanced into the country of Paropamisus, so called from the mountain Paropamisus, which the soldiers of Alexander called *Caucasus*. Having crossed the country in 16 days, he came at length to an opening leading into Media; which finding of a sufficient breadth, he directed a city to be built there, which he called *Alexandria*, as also several other towns about a day's journey distant from thence; and in these places he left 7000 persons, part of them such as had hitherto followed his camp, and part of the mercenary soldiers, who, weary of continual fatigue, were content to dwell there. Having thus settled things in this province, sacrificed solemnly to the gods, and appointed Proceus the Persian president thereof, with a small body of troops under the command of Niloxenus to assist him, he resumed his former design of penetrating into Bactria.

⁹⁰ Bessus, who had assumed the title of *Artaserxes*, when he was assured that Alexander was marching towards him, immediately began to waste all the country between Paropamisus and the river Oxus; which river he passed with his forces, and then burnt all the vessels he had made use of for transporting them, retiring to Nautaca, a city of Sogdia; fully persuaded, that, by the precautions he had taken, Alexander would be compelled to give over his pursuit. This conduct of his, however, disheartened his troops, and gave the lie to all his pretensions; for he had affected to censure Darius's conduct, and had charged him with cowardice, in not defending the rivers Euphrates and Tigris, whereas he now quitted the banks of the most defensible river perhaps in the whole world. As to his hopes, tho' it cannot be said they were ill founded, yet they proved absolutely vain; for Alexander, continuing his march, notwithstanding all the hardships his soldiers sustained, reduced all Bactria under his obedience, particularly the capital Bactria and the strong castle Aornus: in the latter he placed a garrison under the command of Archelaus; but the government of the province he committed to Artabazus. He then continued his march to the river Oxus: on the banks of which when he arrived, he found it three quarters of a mile over, its depth more than proportionable to its breadth, its bottom sandy, its stream so rapid as to render it almost un navigable, and neither boat nor tree in its neighbourhood; so that the ablest commanders in the Macedonian army were of opinion that they should be obliged to march back. The king, however, having first sent away, under a proper escort, all his infirm and worn-out soldiers, that they might be conducted safe to the sea-points, and from thence to Greece, devised a method of passing this river without either boat or bridge, by causing the hides which covered the soldiers' tents and carriages to be stuffed with straw, and then tied together, and thrown into the river. Having crossed the Oxus, he marched directly towards the camp of Bessus, where when he arrived, he found it abandoned; but received at the same time letters from Spitamenes and Dataphernes, who were

the chief commanders under Bessus, signifying, that, if he would send a small party to receive Bessus, they would deliver him into his hands; which they did accordingly, and the traitor was put to death in the manner related in the history of *PERSIA*.

A supply of horses being now arrived, the Macedonian cavalry were remounted. Alexander continued his march to Maracanda the capital of Sogdia, from whence he advanced to the river Iaxartes. Here he performed great exploits against the Scythians; from whom, however, tho' he overcame them, his army suffered much; and the revolted Sogdians being headed by Spitamenes, gave him a great deal of trouble. Here he married Roxana the daughter of Oxyartes, a prince of the country whom he had subdued. But during these expeditions, the king greatly disgusted his army by the murder of his friend Clytus in a drunken quarrel at a banquet, and by his extravagant vanity in claiming divine honours.

At last he arrived at the river Indus, where Hephaestion and Perdicas had already provided a bridge of boats for the passage of the army. The king refreshed his troops for 30 days in the countries on the other side of the river, which were those of his friend and ally Taxiles, who gave him 30 elephants, and joined his army now with 700 Indian horse, to which, when they were to enter upon action, he afterwards added 5000 foot. The true reason of this seems to have been his enmity to Porus, a famous Indian prince, whose territories lay on the other side of the river Hydaspes. During this recess, the king sacrificed with great solemnity; receiving also ambassadors from Ambisirus, a very potent prince, and from Doreares, who was likewise a king in those parts, with tenders of their duty, and considerable presents. These ceremonies over, Alexander appointed Philip governor of Taxila, and put a Macedonian garrison into the place, because he intended to erect an hospital there for the cure of his sick and wounded soldiers. He then ordered the vessels, of which his bridge had been composed when he passed the Indus, to be taken to pieces, that they might be brought to the Hydaspes, where he was informed that Porus with a great army lay encamped to hinder his passage. When he approached the banks of this river with his army and the auxiliaries under the command of Taxiles, he found that the people he had to do with were not so easily to be subdued as the Persians and other Asiatics. The Indians were not only a very tall and robust, but also a very hardy and well-disciplined people; and their king Porus was a prince of high spirit, invincible courage, and great conduct.

It was about the summer solstice when Alexander reached the Hydaspes, and consequently its waters were broader, deeper, and more rapid, than at any other time; for in India the rivers swell as the sun's increasing heat melts the snow, and subside again as winter approaches. Alexander therefore had every difficulty to struggle with. Porus had made his dispositions so judiciously, that Alexander found it impossible to practise upon him as he had done upon others, and to pass the river in his view: wherefore he was constrained to divide his army into small parties, and to practise other arts, in order to get the better of so vigilant a prince. To this end he caused a great quantity of corn and other provisions to be brought into

^{Macedon.} his camp; giving out, that he intended to remain where he was till the river fell, and by becoming fordable should give him an opportunity of forcing a passage: this did not, however, hinder Porus from keeping up very strict discipline in his camp; which when Alexander perceived, he frequently made such motions as seemed to indicate a change of his resolution, and that he had still thoughts of passing the river. The main thing the Macedonians flood in fear of were the elephants; for the bank being pretty steep on the other side, and it being the nature of horses to start at the first appearance of those animals, it was foreseen that the army would be disordered, and incapable of sustaining the charge of Porus's troops.

⁹³ At length Alexander passed the river by the following contrivance. There was, at the distance of 150 stadia from his camp, a rocky promontory projecting into the river, thick covered with wood; and over-against this promontory there lay a pretty large uninhabited island almost overgrown with trees. The king therefore conceived within himself a project of conveying a body of troops from this promontory into that island; and upon this scheme he built his hopes of surprising Porus, vigilant as he was. To this end he kept him and his army constantly alarmed for many nights together, till he perceived that Porus apprehended it was only done to harass his troops, and therefore no longer drew out of his camp, but trusted to his ordinary guards: then Alexander resolved to put his design in execution. A considerable body of horse, the Macedonian phalanx, with some corps of light-armed foot, he left in his camp under the command of Craterus, as also the auxiliary Indians; giving these orders to be observed in his absence, that if Porus marched against him with part of his army and left another part with the elephants behind in his camp, Craterus and his forces should remain where they were; but if it so happened that Porus withdrew his elephants, then Craterus was to pass the river, because his cavalry might then do it safely. Alexander having marched half the way, or about nine of our miles, ordered the mercenary troops under the command of Attalus and other generals, to remain there; and directed them, that as soon as he knew he was engaged with the Indians on the other side, they should pass in vessels provided for that purpose, in order to assist him. Then marching a long way about, that the enemy might not perceive his design of reaching the rock, he advanced as diligently as he could towards that post. It happened very fortunately for him, that a great storm of thunder, lightning, and hail, rose in the night, whereby his march was perfectly concealed, his vessels of 30 oars put together, and his tents stuffed and stitched, so that they passed from the rock into the island, without being perceived, a little before break of day; the storm ceasing just as he and his soldiers were ready for their passage. When they had traversed the island, they boldly set forward to gain the opposite shore in sight of Porus's out-guards, who instantly posited away to give their master an account of the attempt. Alexander landed first himself, and was followed as expeditiously as possible by his forces, whom he took care to draw up as fast as they arrived. When they began their march again, they found that their good fortune was not so great as at first they esteemed it; for it appeared

⁹³ And the Hydaspes with difficulty.

now, that they had not reached the continent at all, but were in truth in another island much larger than the former. They crossed it as fast as they could, and found that it was divided from the *terra firma* by a narrow channel, which, however, was so swelled by the late heavy rain, that the poor soldiers were obliged to wade up to the breast. When they were on the other side, the king drew them up again carefully, ordering the foot to march slowly, they being in number about 6000, while himself with 5000 horse advanced before. As soon as Porus received intelligence that Alexander was actually passing the river, he lent his son with 2000 horse, and 120 armed chariots, to oppose him. But they came too late: Alexander was already got on shore, and even on his march.

When the Macedonian scouts perceived them advance, they informed the king, who sent a detachment to attack them, remaining still at the head of his cavalry in expectation of Porus. But when he found that this party was unsupported, he instantly attacked with all his horse, and defeated them with the slaughter of many, and the loss of all their armed chariots, the son of Porus being slain in the fight. The remainder of the horse returning to the camp with this disastrous account, Porus was in some confusion; however, he took very quickly the best and wisest resolutions his circumstances would allow; which were, to leave a part of his army, with some of his elephants, to oppose Craterus, who was now about to pass the river also; and, with the rest, to march against Alexander and his forces, who were already passed. This resolution once taken, he marched immediately out of his camp, at the head of 4000 horse, 30,000 foot, 300 chariots, and 200 elephants. He advanced as expeditiously as he could, till he came into a plain which was firm and sandy, where his chariots and elephants might act to advantage: there he halted, that he might put his army in order, knowing well that he need not go in quest of his enemy. Alexander soon came up with his horse, but he did not charge Porus; on the contrary, he halted, and put his troops in order, that they might be able to defend themselves in case they were attacked. When he had waited some time, his foot arrived; whom he immediately surrounded with his horse, that, after so fatiguing a march, they might have time to cool and breathe themselves, before they were led to engage. Porus permitted all this, because it was not his interest to fight, and because he depended chiefly upon his order of battle, the elephants covering his foot, so that the Macedonians could not charge them.

When Alexander had disposed his foot in proper order, he placed his horse on the wings: and, observing that he was much superior in them to the enemy, and that the cavalry of Porus were easy to be charged, he resolved to let the foot have as little share as possible in the battle. To this end, having given the necessary directions to Cænus who commanded them, he went himself to the right, and with great fury fell upon the left wing of Porus. The dispute, tho' short, was very bloody: the cavalry of Porus, tho' they fought gallantly, were quickly broken; and the foot being by this means uncovered, the Macedonians charged them. But the Indian horse rallying, came up to their relief, yet were again defeated. By this time the archers had wounded

^{Macedon.} The son of Porus defeated and killed.

⁹⁵ Porus himself defeated.

⁹⁶ Macedon wounded many of the elephants, and killed most of their riders, so that they did not prove less troublesome and dangerous to their own side than to the Macedonians; whence a great confusion ensued: and Cœnus, taking this opportunity, fell in with the troops under his command, and entirely defeated the Indian army. Porus himself behaved with the greatest intrepidity, and with the most excellent conduct: he gave his orders, and directed every thing, as long as his troops retained their form; and, when they were broken, he retired from party to party as they made stands, and continued fighting till every corps of Indians was put to the rout. In the mean time Craterus had passed with the rest of the Macedonian army; and these, falling upon the flying Indians, increased the slaughter of the day excessively, inasmuch that 20,000 foot and 3000 horse were killed, all the chariots were hacked to pieces, and the elephants not killed were taken: two of Porus's sons fell here, as also most of his officers of all ranks.

As for Porus, Alexander gave strict directions that no injury might be done to his person: he even sent Taxiles to persuade him to surrender himself, and to assure him that he should be treated with all the kindness and respect imaginable; but Porus, disdainful of this advice from the mouth of an old enemy, threw a javelin at him, and had killed him but for the quick turn of his horse. Meroë the Indian, who was also in the service of Alexander, succeeded better: he had been the old acquaintance of Porus; and therefore when he intreated that prince to spare his person, and to submit himself to fortune and a generous victor, Porus followed his advice; and we may truly say, that the condition of this Indian king suffered nothing by the loss of the battle. Alexander immediately gave him his liberty, restored him shortly after to his kingdom, to which he annexed provinces almost equal to it in value. Neither was Alexander a loser by his munificence; for Porus remained his true friend and constant ally.

To perpetuate the memory of this victory, Alexander ordered two cities to be erected; one on the field of battle, which he named *Nicaa*; the other on this side the river, which he called *Bucephala*, in honour of his horse Bucephalus, who died here, as Arrian says, of mere old age, being on the verge of 30. All the soldiers, who fell in battle, he buried with great honours; offered solemn sacrifices to the gods, and exhibited pompous shows on the banks of the Hydaspes, where he had forced his passage. He then entered the territories of the Glaucis, in which were 37 good cities, and a multitude of populous villages. All these were delivered up to him without fighting; and as soon as he received them, he presented them to Porus; and having reconciled him to Taxiles, he sent the latter home to his own dominions. About this time ambassadors arrived from some Indian princes with their submissions; and Alexander having conquered the dominions of another Porus, which lay on the Hydraotes a branch of the Indus, added them to those of Porus his ally.

In the middle of all this success, however, news arrived, that the Cathi, the Oxydrace, and the Malli, the most warlike nations of India, were confederated against the Macedonians, and had drawn together a

great army. The king immediately marched to give them battle; and in a few days reached a city called *Sangala*, seated on the top of an hill, and having a fine lake behind it. Before this city the confederate Indians lay encamped, having three circular lines of carriages locked together, and their tents pitched in the centre. Notwithstanding the apparent difficulty of forcing these intrenchments, Alexander resolved immediately to attack them. The Indians made a noble defence; but at last the first line of their carriages was broken, and the Macedonians entered. The second was stronger by far; yet Alexander attacked that too, and after a desperate resistance forced it. The Indians, without trusting to the third, retired into the city; which Alexander would have invested: but the foot he had with him not being sufficient for that purpose, he caused his works to be carried on both sides as far as the lake; and, on the other side of that, ordered several brigades of horse to take post; ordering also battering engines to be brought up, and in some places employing miners. The second night, he received intelligence that the besieged, knowing the lake to be fordable, intended to make their escape through it. Upon this the king ordered all the carriages which had been taken in forcing their camp to be placed up and down the roads, in hopes of hindering their flight; giving directions to Ptolemy, who commanded the horse on the other side of the lake, to be extremely vigilant, and to cause all his trumpets to sound, that the forces might repair to that post where the Indians made their greatest effort. These precautions had all the effect that could be desired: for of the few Indians who got through the lake, and passed the Macedonian horse, the greater part were killed on the roads; but the greatest part of their army was constrained to retire again through the water into the city. Two days after, the place was taken by storm. Seventeen thousand Indians were killed; 70,000 taken prisoners; with 300 chariots, and 500 horse. The Macedonians are said to have lost only 100 men in this siege; but they had 1200 wounded, and among these several persons of great distinction.

The city was no sooner taken, than Alexander dispatched Eumenes his secretary, with a party of horse, to acquaint the inhabitants of the cities adjacent with what had befallen the Sangalans; promising also, that they should be kindly treated if they would submit. But they were so much affrighted at what had happened to their neighbours, that, abandoning all their cities, they fled into the mountains; choosing rather to expose themselves to wild beasts, than to these invaders, who had treated their countrymen so cruelly. When the king was informed of this, he sent detachments of horse and foot to scour the roads; and these, finding aged, infirm, and wounded people, to the number of about 500, put them to the sword without mercy. Perceiving that it was impossible to persuade the inhabitants to return, he caused the city of Sangala to be raised, and gave the territories to the few Indians who had submitted to him.

Alexander, still unsated with conquest, now prepared to pass the Hyphasis. The chief reason which induced him to think of this expedition was, the information he had received of the state of the countries

Macedon.

Sangala ta.
ken,

And raised.

⁹⁶
He submits to Alexander.

Macedon. beyond that river. He was told that they were in themselves rich and fruitful; that their inhabitants were not only a very martial people, but very civilized; that they were governed by the nobility, who were themselves subject to the laws; and that as they lived in happiness and freedom, it was likely they would fight obstinately in defence of those blessings. He was farther told, that among these nations there were the largest, strongest, and most useful elephants bred and tamed; and was therefore fired with an earnest desire to reduce such a bold and brave people under his rule, and of attaining to the possession of the many valuable things that were said to be amongst them. As exorbitant, however, as his personal ambition was, he found it impossible to infuse any part of it into the minds of his soldiers; who were so far from wishing to triumph over new and remote countries, that they were highly desirous of leaving those that they had already conquered. When therefore they were informed of the king's intentions, they privately consulted together in the camp about the situation of their own affairs. At this consultation, the gravest and best of the soldiers lamented that they were made use of by their king, not as lions, who fall fiercely upon those who have injured them; but as masts, who fly upon and tear those who are pointed out to them as enemies. The rest were not so modest; but expressed themselves roundly against the king's humour for leading them from battle to battle, from siege to siege, and from river to river; protesting that they would follow him no further, nor lavish away their lives any longer, to purchase fame for him.

99
Alexander's troops
refuse to proceed
further.

Alexander was a man of too much penetration not to be early in perceiving that his troops were very uneasy. He therefore harangued them from his tribunal; but though his eloquence was great, and the love his army had for him was yet very strong, they did not relent. For some time the soldiers remained sullen and silent; and at last turned their eyes on Cœnus, an old and experienced general, whom Alexander loved, and in whom the army put great confidence.—He had the generosity to undertake their cause; and told Alexander frankly, “that men endured toil in hopes of repose; that the Macedonians were already much reduced in their numbers; that of those who remained, the greater part were invalids; and that they expected, in consideration of their former services, that he would now lead them back to their native country: an act which, of all others, would most contribute to his own great designs; since it would encourage the youth of Macedon, and even of all Greece, to follow him in whatever new expedition he pleased to undertake.” The king was far from being pleased with this speech of Cœnus, and much less with the disposition of his army, which continued in a deep silence. He therefore dismissed the assembly: but next day he called another, wherein he told the soldiers plainly, that he would not be driven from his purpose; that he would proceed in his conquests with such as should follow him voluntarily: as for the rest, he would not detain them, but would leave them at liberty to go home to Macedon, where they might publish, “that they had left their king in the midst of his enemies.” Even this expedient had no success; his army was so thoroughly tired with long marches and

deperate battles, that they were determined to go no further, either for fair speeches or foul. Upon this Alexander retired to his tent, where he refused to see his friends, and put on the same gloomy temper that reigned among his troops. For three days things remained in this situation. At last the king suddenly appeared; and, as if he had been fully determined to pursue his first design, he gave orders for fabricating for the good success of his new undertaking. Aristander the augur reported, that the omens were altogether inauspicious; upon which the king said, that since his proceeding farther was neither pleasing to the gods nor grateful to his army, he would return. When this was rumoured among the army, they assembled in great numbers about the royal tent, saluting the king with loud acclamations, wishing him success in all his future designs; giving him at the same time hearty thanks, for that “he who was invincible had suffered himself to be overcome by their prayers.”

100
He consents to return.

A stop being thus put to the conquests of Alexander, he determined to make the Hyphasis the boundary of his dominions; and having erected twelve altars of an extraordinary magnitude, he sacrificed on them: after which he exhibited shows in the Grecian manner; and, having added all the conquered country in these parts to the dominions of Porus, he began to return. Having arrived at the Hydaspes, he made the necessary preparations for sailing down the Indus into the ocean. For this purpose, he ordered vast quantities of timber to be felled in the neighbourhood of the Hydaspes, through which he was to sail into the Indus; he caused the vessels with which he had passed other rivers to be brought thither, and assembled a vast number of artificers capable of repairing and equipping his fleet; which, when finished, consisted of 80 vessels of three banks of oars, and 2000 lesser ships and transports. Those who were to manœuvre this fleet were collected out from the Phœnicians, Cyprians, Carians, and Egyptians following his army, and who were reckoned perfectly well skilled in the naval art. When all things were ready, the army embarked about break of day; the king, in the mean time, sacrificing to the gods according to the ceremonies used in his own country, and likewise according to those of the country where he now was. Then he himself went on board; and causing the signal to be given by sound of trumpet, the fleet set sail. Craterus and Hephaestion had marched some days before with another division of the army; and in three days the fleet reached that part of the river which was opposite to their camps. Here he had information, that the Oxydrææ and Malli were raising forces to oppose him; upon which he immediately determined to reduce them; for, during this voyage, he made it a rule to compel the inhabitants on both sides of the river to yield him obedience. But before he arrived on the coasts of the people above mentioned, he himself sustained no small danger; for, coming to the confluence of the Acesines with the Hydaspes, from whence both rivers roll together into the Indus, the eddies, whirlpools, and rapid currents, rushing with tremendous noise from the respective channels of those rivers into the great one formed by them both, at once terrified those who navigated his vessels, and actually

101
Sails down the Indus.

Macedon

tually destroyed many of the long vessels, with all who were aboard of them; the king himself being in some danger, and Nearchus the admiral not a little at a loss. As soon as this danger was over, Alexander went on shore; and having ordered his elephants with some troops of horse and archers to be carried across, and put under the command of Craterus, he then divided his army on the left-hand bank into three bodies; the first commanded by himself, the second by Hyphæstion, and the third by Ptolemy. Hyphæstion had orders to move silently through the heart of the country, five days march before the king; that if, on Alexander's approach, any of the barbarians should attempt to shelter themselves by retiring into the country, they might fall into the hands of Hyphæstion. Ptolemy Lagus was ordered to march three days journey behind the king, that if any escaped his army, they might fall into Ptolemy's hands; and the fleet had orders to stop at the confluence of this river with the Hydrates till such time as these several corps should arrive.

102
His expedition against the Malli.

Alexander himself, at the head of a body of horse and light armed foot, marched through a desert country against the Malli; and, scarce affording any rest to his soldiers, arrived in three days at a city into which the barbarians had put their wives and children, with a good garrison for their defence. The country people, having no notion that Alexander would march through such a desert and barren region, were all unarmed, and in the utmost confusion. Many of them therefore were slain in the field; the rest fled into the city, and shut the gates. But this only protracted their fate for a short time; for the king, having ordered the city to be invested by his cavalry, took it, as well as the castle, by storm, and put all he found there to the sword. He sent at the same time Perdiccas with a considerable detachment, to invest another city of the Malli at a considerable distance; but when he came there, he found it abandoned. However, he pursued the inhabitants who had but lately left it, and killed great numbers of them on the road. After this the king took several other cities, but not without considerable resistance; for the Indians sometimes chose to burn themselves in their houses, rather than surrender. At last he marched to their capital city; and finding that abandoned, he proceeded to the river Hydrates, where he found 50,000 men encamped on the opposite bank, in order to dispute his passage. He did not hesitate, however, to enter the river with a considerable party of horse; and so much were the Indians terrified at his presence, that their whole army retired before him. In a short time they returned and attacked him, being ashamed to fly before such an inconsiderable number; but in the mean time the rest of the Macedonian forces came up, and the Indians were obliged to retire to a city which lay behind them, and which Alexander invested that very night. The next day he stormed the city with such violence, that the inhabitants were compelled to abandon it, and to retire to the castle, where they prepared for an obstinate defence. The king instantly gave orders for scaling the walls, and the soldiers prepared to execute these orders as fast as they could; but the king being impatient caught hold of a ladder and mounted it first himself, being followed

Macedon.

103
His desperate valour and danger.

by Leonatus, Puceallas, and Abreas, the latter a man of great valour, and who on that account had double pay allowed him. The king having gained the top of the battlements, cleared them quickly of the defendants, killing some of them with his sword, and pushing others over the walls; but after this was done, he was in more danger than ever; for the Indians galled him with their arrows from the adjacent towers, though they durst not come near enough to engage him. His own battalion of targeteers mounting in haste to second him, broke the ladders; which, as soon as Alexander perceived, he threw himself down into the castle, as did also Puceallas, Leonatus, and Abreas. As soon as the king was on the ground, the Indian general rushed forward to attack him; but Alexander instantly dispatched him, as well as several others who followed him. Upon this the rest retired, and contented themselves with throwing darts and stones at him at a distance. Abreas was struck into the head with an arrow, and died on the spot; and, shortly after, another pierced through the king's breast-plate into his body. As long as he had spirits, he defended himself valiantly; but, through a vast effusion of blood, losing his senses, he fell upon his shield. Puceallas then covered him with the sacred shield of Pallas on one side, as did Leonatus with his own shield on the other, though they themselves were dreadfully wounded. In the mean time, however, the soldiers on the outside, eager to save their king, supplied their want of ladders by driving large iron pins into the walls. By the help of these many of them ascended, and came to the assistance of Alexander and his companions. The Indians were now slaughtered without mercy; but Alexander continued for some time in a very dangerous way; however, he at last recovered his strength, and showed himself again to his army, which filled them with the greatest joy.

104
Is with difficulty saved by his men.

The Malli, being now convinced that nothing but submission could save the remainder of them, sent deputies to Alexander, offering the dominion of their country; as did also the Oxydrace: and the king having settled every thing in these countries agreeable to his mind, proceeded on his voyage down the river Indus. In this voyage he received the submission of some other Indian princes; and perceiving, that, at the point of the island Pattala, the river divided itself into two vast branches, he ordered an haven and convenient docks to be made there for his ships; and when he had careened his fleet, he sailed down the right-hand branch towards the ocean. In his passage he sustained great difficulties by reason of his want of pilots, and at the mouth of the river very narrowly missed being cast away; yet all this did not hinder him from pursuing his first design, though it does not appear that he had any other motive thereto than the vain desire of boasting that he had entered the ocean beyond the Indus: for, having consecrated certain bulls to Neptune, and thrown them into the sea, performed certain libations of golden cups, and thrown the cups also into the sea, he came back again; having only surveyed two little islands, one at the mouth of the Indus, and one a little further in the ocean.

105
He proceeds in his voyage down the Indus.

On the king's return to Pattala, he resolved to sail down the other branch of the Indus, that he might

see.

Macedon.

See whether it was more safe and commodious for his fleet than that which he had already tried; and for this he had very good reasons. He had resolved to send Nearchus with his fleet by sea, through the Persian gulf up the river Tygris, to meet him and his army in Mesopotamia; but as the possibility of this voyage depended on the ceasing of the Etesian winds, there was a necessity of laying up the fleet till the season should prove favourable. Alexander, therefore, sailing through this branch of the Indus, fought on the sea-coast for bays and creeks, where his fleet might anchor in safety; he caused also pits to be sunk, which might be filled with fresh water for the use of his people; and took all imaginable precautions for preserving them in ease and safety till the season would allow them to continue their voyage. In this he succeeded to his wish; for he found this branch of the river Indus, at its mouth, spread over the plain country and forming a kind of lake, wherein a fleet might ride with safety. He therefore appointed Leonatus, and a part of his army, to carry on such works as were necessary; causing them to be relieved by fresh troops as often as there was occasion: then having given his last instructions to Nearchus, he departed with the rest of the army, in order to march back to Babylon.

106
Sets out for
Babylon.

Before the king's departure, many of his friends advised him against the route which he intended to take. They told him, that nothing could be more rash or dangerous than this resolution. They acquainted him, that the country through which he was to travel was a wild uncultivated desert; that Semiramis, when she led her soldiers this way out of India, brought home but 20 of them; and that Cyrus, attempting to do the same, returned with only seven. But all this was so far from deterring Alexander, that it more than ever determined him to pursue no other road. As soon, therefore, as he had put things in order, he marched at the head of a sufficient body of troops to reduce the Oritæ, who had never vouchsafed either to make their submission or to court his friendship. Their territories lay on the other side of a river called *Arabis*, which Alexander crossed so speedily, that they had no intelligence of his march; whereupon most of them quitted their country, and fled into the deserts. Their capital he found so well situated, that he resolved to take it out of their hands, and to cause a new and noble city to be founded there, the care of which he committed to Hephæstion. Then he received the deputies of the Oritæ and Gedrosi; and having assured them, that if the people returned to their villages, they should be kindly treated, and having appointed Apollophanes president of the Oritæ, and left a considerable body of troops under Leonatus to secure their obedience, he began his march through Gedrosia. In this march his troops suffered incredible hardships. The road was very uncertain and troublesome, on account of its lying thro' deep and loose sands, rising in many places into hillocks, which forced the soldiers to climb, at the same time that it sunk under their feet; there were no towns, villages, nor places of refreshment, to be met with; so that, after excessive marches, they were forced to encamp among these dry sands. As to provisions, they hardly met with any during their whole march. The soldiers were therefore obliged to kill their

107
His dangerous
march
through
Gedrosia.

beasts of carriage: and such as were sent to bring some corn from the sea-side, were so grievously distressed, that, though it was sealed with the king's signet, they cut open the bags, choosing rather to die a violent death for disobedience than perish by hunger. When the king, however, was informed of this, he freely pardoned the offenders; he was also forced to accept the excuses that were daily made for the loss of mules, horses, &c. which were in truth eaten by the soldiers, and their carriages broken in pieces to avoid further trouble. As for water, their want of it was a great misfortune; and yet their finding it in plenty was sometimes a greater: for, as by the first they perished with thirst, so by the latter they were burnt, thrown into dropsies, and rendered incapable of travel. Frequently they met with no water for the whole day together: sometimes they were disappointed of it at night; in which case, if they were able, they marched on; so that it was common with them to travel 30, 40, 50, or even 60 miles without encamping. Numbers through these hardships were obliged to lag in the rear; and of these many were left behind, and perished; for indeed scarce any ever joined the army again. Their miseries, however, they sustained with incredible patience, being encouraged by the example of their king; who, on this occasion, suffered greater hardships than the meanest soldier in his army. At last they arrived at the capital of Gedrosia, where they refreshed themselves, and staid some time: after which, they marched into Caramania; which being a very plentiful country, they there made themselves ample amends for the hardships and fatigues they had sustained. Here they were joined first by Craterus with the troops under his command, and a number of elephants; then came Stasanor president of the Arians, and Pharissmanes the son of Phrataphernes governor of Parthia. They brought with them camels, horses, and other beasts of burden, in vast numbers; having foreseen, that the king's march thro' Gedrosia would be attended with the loss of the greatest part, if not of all the cavalry and beasts belonging to his army.

Macedon.

108
He arrives
in Caramania.

During Alexander's stay in Caramania, he redressed the injuries of his people, who had been grievously oppressed by their governors during his absence. Here also he was joined by his admiral Nearchus, who brought him an account that all under his command were in perfect safety, and in excellent condition; with which the king was mightily pleased, and, after having bestowed on him singular marks of his favour, sent him back to the navy. Alexander next set out for Persia, where great disorders had been committed during his absence. These also he redressed, and caused the governor to be crucified; appointing in his room Peucestas, who saved his life when he fought singly against a whole garrison as above related. The new governor was no sooner invested with his dignity, than he laid aside the Macedonian garb, and put on that of the Medes; being the only one of Alexander's captains, who, by complying with the manners of the people he governed, gained their affection.

109
Redresses
the grievances
of his people.

While Alexander visited the different parts of Persia, he took a view, among the rest, of the ruins of Persepolis, where he is said to have expressed great sorrow for the destruction he had formerly occasioned. From Persepolis he marched to Susa, where he gave

an

Bellows for inflating the Lungs, in order to restore suspended respiration.

Plate CCLXXV

Fig. 1.

Fig. 6.

Fig. 2.

Fig. 3.

Fig. 4.

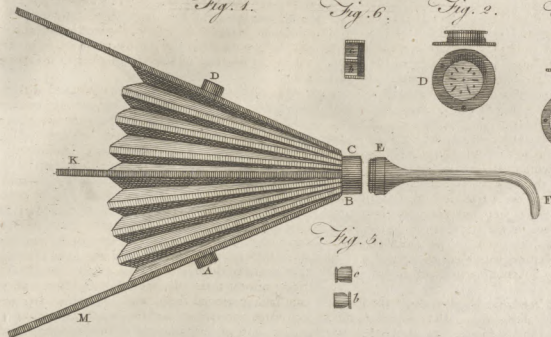


Fig. 5.



Fig. 1.

Ancient Lyres. Fig. 5.

Fig. 2.

Fig. 6.



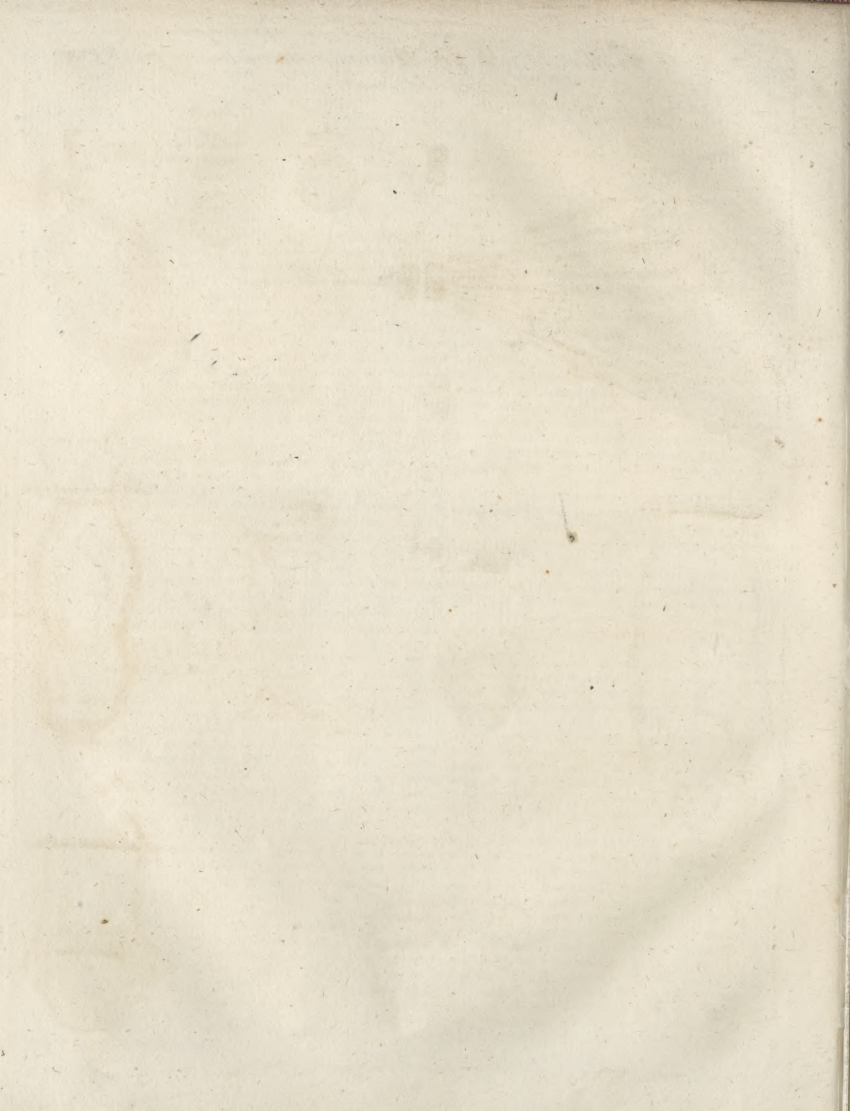
Fig. 3.

Lucanus.

Fig. 4.



A. Bell. Pin. Nal. Sculptor fecit.



Macedon.

an extraordinary loofe to pleasure; refolving to make himfelf and his followers fome amends for the difficulties they had hitherto undergone; purpofing at the fame time to effectually to unite his new conquered with his hereditary fubjects, that the jealousies and fears, which had hitherto tormented both, fhould no longer fubfift. With this view he married two wives of the blood royal of Perfia; viz. Barine, or Statira, the daughter of Darius, and Paryfatis the daughter of Ochus. Drypetis, another daughter of Darius, he gave to Hephæftion; Amaftine, the daughter of Oxyartes the brother of Darius, married Craterus; and to the reft of his friends, to the number of 80, he gave other women of the greateft quality. All thefe marriages were celebrated at once, Alexander himfelf beftowing fortunes upon them; he directed likewife to take account of the number of his officers and foldiers who had married Afatic wives; and tho' they appeared to be 10,000, yet he gratified each of them according to his rank. He next refolved to pay the debts of his army, and thereupon iffued an edict directing every man to register his name and the fum he owed; with which the foldiers complying flowly, from an apprehenfion that there was fome design againft them, Alexander ordered tables heaped with money to be fet in all quarters of the camp, and caufed every man's debts to be paid on his bare word, without even making any entry of his name; though the whole fum came to 20,000 talents. On fuch as had diftinguifhed themfelves in an extraordinary manner, he beftowed crowns of gold. Peuceftas had the firft; Leonatus the fecond; Nearchus the third; Onesicritus the fourth; Hephæftion the fifth; and the reft of his guards had each of them one. After this he made other difpofitions for conciliating, as he fuppofed, the differences among all his fubjects. He reviewed the 30,000 youths, whom at his departure for India he had ordered to be taught Greek and the Macedonian difcipline; expreffing high fatisfaction at the fine appearance they made, which rendered them worthy of the appellation he beftowed on them, viz. that of *Epigoni*, i. e. fucceffors. He promoted alfo, without any diftinction of nation, all thofe who had ferved him faithfully and valiantly in the Indian war. When all thefe regulations were made, he gave the command of his heavy armed troops to Hephæftion, and ordered him to march directly to the banks of the Tigris, while in the mean time a fleet was equipped for carrying the king and the troops he retained with him down to the ocean.

Thus ended the exploits of Alexander; the greateft conqueror that ever the world faw, at leaft with refpect to the rapidity of his conquefts. In 12 years time he had brought under his fubjection Egypt, Libya, Afia Minor, Syria, Phœnicia, Paleftine, Babylon, Perfia, with part of India and Tartary. Still, however, he meditated greater things. He had now got a great taftè in maritime affairs; and is faid to have meditated a voyage to the cofts of Arabia and Ethiopia, and thence round the whole continent of Africa to the Straits of Gibraltar. But of this there is no great certainty; though that he intended to fubdue the Carthaginians and Italians, is more than probable. All thefe designs, however, were frustrated by his death, which happened at Babylon in 323 B. C.

170
Marries
other two
wives.

171
Pays the
debts of his
army.

He is faid to have received feveral warnings of his approaching fate, and to have been advifed to avoid that city; which advice he either defpised or could not follow. He died of a fever after eight days illnefs, without naming any fucceffor; having only given his ring to Perdicas, and left the kingdom, as he faid, to the moft worthy.

172
He dies at
Babylon.

The character of this great prince has been variously reprefented; but moft hiftorians feem to have looked upon him rather as an illuftrious madman than one upon whom the epithet of *Great* could be properly beftowed. From a careful obfervation of his conduct, however, it muft appear, that he poffeffed not only a capacity to plan, but likewife to execute, the greateft enterprifes that ever entered into the mind of any of the human race. From whatever caufe the notion originated, it is plain that he imagined himfelf a divine perfon, and born to fubdue the whole world; and extravagant and impracticable as this fcheme may appear at prefent, it cannot at all be looked upon in the fame light in the time of Alexander. The Greeks were in his time the moft powerful people in the world in refpect to their skill in the military art, and the Perfians were the moft powerful with refpect to wealth and numbers. The only other powerful people in the world were the Carthaginians, Gauls, and Italian nations. From a long feries of wars which the Carthaginians carried on in Sicily, it appeared that they were by no means capable of contending with the Greeks even when they had an immense fuperiority of numbers; much lefs then could they have fufained an attack from the whole power of Greece and Afia united. The Gauls and Italians were indeed very brave, and of a martial difpofition; but they were barbarous, and could not have refifted armies well difciplined and under the command of fuch a fkillful leader as Alexander. Even long after his time, it appeared that the Romans themfelves could not have refifted the Greeks; fince Regulus, after having defeated the Cathaginians and reduced them to the utmoft diftreff, was totally unable to refift a Carthaginian army commanded by a Greek general, and guided by Greek difcipline.

173
His charac-
ter.

Thus it appears, that the fcheme of Alexander cannot by any means be accounted that of a madman, or of one who projects great things without judgment or means to execute them. If we confider from his actions the end which moft probably he had in view, could his fcheme have been accomplished, we fhall find it not only the greateft but the *beft* that can poffibly be imagined. He did not conquer to destroy, enflave, or opprefs; but to civilize, and unite the whole world as one nation. No fooner was a province conquered than he took care of it as if it had been part of his paternal inheritance. He allowed not his foldiers to opprefs and plunder the Perfians, which they were very much inclined to do; on the contrary, by giving into the oriental cuftoms himfelf, he ftrve to extinguish that inveterate hatred which had fo long fubfifted between the two nations. In the Scythian countries which he fubdued, he purfued the fame excellent plan. His courage and military fkill, in which he never was excelled, were difplayed, not with a view to rapine or defultory conqueft, but to civilize and induce the barbarous inhabitants to employ themfelves in a more pro-

Macedon. per way of life. "Amidst the hardships of a military life (says Dr Gillies), obfinate fies, bloody battles, and dear bought victories, he ill refpected the rights of mankind, and prafticed the mild virtues of humanity. The conquered nations enjoyed their ancient laws and privileges; the rigorous of defpotifm foftened; arts and induftry encouraged; and the proudeft Macedonian governors compelled, by the authority and example of Alexander, to obferve the rules of juftice towards their meaneft fubjects. To bridle the fierce inhabitants of the Scythian plains, he founded cities and eftablifhed colonies on the banks of the Iaxartes and Oxus; and thofe deftructive campaigns ufually afcribed to his reffeis activity and blind ambition, appeared to the difcernment of this extraordinary man not only effential to the fequity of the conquefts which he had already made, but neceffary for the more remote and fplendid expeditions which he ftill purpofed to undertake, and which he performed with fingular boldnefs and unexampled fuccels."—In another place the fame author gives his character in the following words.

"He was of a low ftature, and fomewhat deformed; but the activity and elevation of his mind animated and ennobled his frame. By a life of continual labour, and by an early and habitual praftice of the gymnastic exercifes, he had hardened his body againft the impreffions of cold and heat, hunger and thirft, and prepared his robuft conftitution for bearing fuch exertions of ftrength and activity, as have appeared incredible to the undifciplined foftnefs of modern times. In generofity and in proofs, he rivalled the greateft heroes of antiquity; and in the race of glory, having finally outftripped all competitors, became ambitious to furpafs himfelf. His fuperior fkill in war gave uninterrupted fuccels to his arms; and his natural humanity, enlightened by the philofophy of Greece, taught him to improve his conquefts to the beft interefts of mankind. In his extenfive dominions, he built or founded not lefs than 70 cities; the fituation of which being chofen with confummate wifdom, tended to facilitate communication, to promote commerce, and to difufe civility through the greateft nations of the earth. It may be fufpected, indeed, that he miftook the extent of human power, when in the courfe of one reign he undertook to change the face of the world; and that he miscalculated the ftubbornnefs of ignorance and the force of habit, when he attempted to enlighten barbarifm, to foften fervitude, and to transplant the improvements of Greece into an African and Afatic foil, where they have never been known to flourish. Yet let not the defigns of Alexander be too haftily accufed of extravagance. Whoever ferioufly confiders what he actually performed before his 33d year, will be cautious of determining what he might have accomplished had he reached the ordinary term of human life. His refources were peculiar to himfelf; and fuch views as well as actions became him as would have become none befides. In the language of a philofophical hiftorian, 'he feems to have been given to the world by a peculiar difpenfation of Providence, being a man like to none other of the human kind.'

"From the part which his father Philip and himfelf acted in the affairs of Greece, his hiftory has been

Macedon. tranfmitted through the impure channels of exaggerated flattery or malignant envy. The innumerable fictions, which difgrace the works of his biographers, are contradicted by the moft authentic accounts of his reign, and inconffift with thofe public tranfaftions which concurring authorities confirm. In the prefent work it feemed unneceffary to expatiate on fuch topics, fince it is lefs the bufinefs of hiftory to repeat or even to expofe errors than to felect and imprefs ufeul truths. An author, ambitious of attaining that purpofe, can feldom indulge the language of general panegyric. He will acknowledge, that Alexander's actions were not always blamelefs; but, after the moft careful examination, he will affirm, that his faults were few in number, and refulted from his fituation rather than from his character.

"From the firt years of his reign he experienced the crimes of difaffection and treachery, which multiplied and became more dangerous with the extent of his dominions and the difficulty to govern them. Several of his lieutenants early afpired at independence; others formed confpiracies againft the life of their mafter. The firt criminals were treated with a lenity becoming the generous fpirit of Alexander: But when Philotas, the fon of Parmenio, and even Parmenio himfelf, afforded reafon to fufpect their fidity; when the Macedonian youths, who, according to the institution of Philip, guarded the royal pavilion, prepared to murder their fovereign, he found it neceffary to depart from his lenient fyftem, and to hold with a firmer hand the reins of government. Elated by unexampled profperity, and the fubmiffive reverence of vanquifhed nations, his loftinefs difguifed the pride of his European troops, particularly the Macedonian nobles, who had been accuftomed to regard themfelves rather as his companions than fubjects. The pretentions which foud policy taught him to form and to maintain, of being treated with thofe external honours ever claimed by the monarchs of the Eaft, highly offended the religious prejudices of the Greeks, who deemed it impious to proftrate the body or bend the knee to any mortal fovereign. Yet had he remitted formalities confecrated by the praftice of ages, he muft infenfibly have loft the refpect of his Afatic fubjects. With a view to reconcile the difcordant principles of the victors and vanquifhed, he affected an immediate defcent from Jupiter Ammon, a claim liberally admitted by the avarice or fears of the Libyan priefts; and which, he had reafon to expect, could not be very obftinately denied by the credulity of the Greeks and Macedonians, who univerfally acknowledged that Philip, his reputed father, was remotely defcended from the Grecian Jupiter. But the fuccels of this defign, which might have intitled him, as fon of Jupiter, to the fame obedience from the Greeks which the barbarians readily paid him as monarch of the Eaft, was counteracted, at firt by the fecret difpleafure, and afterwards by the open indignation, of fveral of his generals and courtiers. Nor did the conduct of Alexander tend to extricate him from this difficulty. With his friends he maintained that equal intercourfe of vifits and entertainments which characterized the Macedonian manners; indulged the liberal flow of unguarded converfation; and often exceeded that intemperance in wine which difgraced his age and country."

W e shall conclude this character of Alexander with observing, that he had in view, and undoubtedly must have accomplished, the sovereignty of the ocean as well as of the land. The violent resistance made by the Tyrians had shown him the strength of a commercial nation; and it was undoubtedly with a view to enrich his dominions by commerce, that he equipped the fleet on the Indus, and wished to keep up a communication with India by land as well as by sea. "It was chiefly with a view to the latter of these objects (says Dr Robertson), that he examined the navigation of the Indus with so much attention. With the same view, on his return to Susa, he in person surveyed the course of the Euphrates and Tigris, and gave directions to remove the cataracts or dams with which the ancient monarchs of Persia, induced by a peculiar precept of their religion, which enjoined them to guard with the utmost care against defiling any of the elements, had constructed near the mouths of these rivers, in order to shut out their subjects from any access to the ocean. By opening the navigation in this manner, he proposed, that the valuable commodities of India should be conveyed from the Persian Gulf into the interior parts of his Asiatic dominions, while by the Arabian Gulf they should be carried to Alexandria, and distributed to the rest of the world.

"Grand and extensive as these schemes were, the precautions employed, and the arrangements made for carrying them into execution, were so various and so proper, that Alexander had good reason to entertain sanguine hopes of their proving successful. At the time when the mutinous spirit of his soldiers obliged him to relinquish his operations in India, he was not 30 years of age complete. At this enterprising period of life, a prince of a spirit so active, persevering, and indefatigable, must have soon found means to resume a favourite measure on which he had been long intent. If he had invaded India a second time, he would not, as formerly, have been obliged to force his way through hostile and unexplored regions, opposed at every step by nations and tribes of barbarians whose names had never reached Greece. All Asia, from the shores of the Ionian sea to the banks of the Hyphasis, would then have been subject to his dominion; and through that immense stretch of country he had established such a chain of cities or fortified stations, that his armies might have continued their march with safety, and have found a regular succession of magazines provided for their subsistence. Nor would it have been difficult for him to bring into the field forces sufficient to have achieved the conquest of a country so populous and extensive as India. Having armed and disciplined his subjects in the East like Europeans, they would have been ambitious to imitate and to equal their instructors; and Alexander might have drawn recruits, not from his scanty domains in Macedonia and Greece, but from the vast regions of Asia, which in every age has covered the earth, and astonished mankind with its numerous armies. When at the head of such a formidable power he had reached the confines of India, he might have entered it under circumstances very different from those in his first expedition. He had secured a firm footing there, partly by means of the garisons which he left in the three cities which he had built and fortified, and partly by his alliance

with Taxiles and Porus. These two Indian princes, won by Alexander's humanity and beneficence, which, as they were virtues seldom displayed in the ancient mode of carrying on war, excited of course an higher degree of admiration and gratitude, had continued steady in their attachment to the Macedonians. Reinforced by their troops, and guided by their information as well as by the experience which he had acquired in his former campaigns, Alexander must have made rapid progress in a country where every invader from his time to the present age has proved successful.

"But this and all his other splendid schemes were terminated at once by his untimely death. In consequence of that, however, events took place which illustrate and confirm the justness of the preceding speculations and conjectures by evidence the most striking and satisfactory. When that great empire, which the superior genius of Alexander had kept united and in subjection, no longer felt his superintending control, it broke into pieces, and its various provinces were seized by his principal officers, and parcelled out among them. From ambition, emulation, and personal animosity, they soon turned their arms against one another; and as several of the leaders were equally eminent for political abilities and for military skill, the contest was maintained long, and carried on with frequent vicissitudes of fortune. Amidst the various convulsions and revolutions which these occasioned, it was found that the measures of Alexander for the preservation of his conquests had been concerted with such sagacity, that upon the final restoration of tranquillity, the Macedonian dominion continued to be established in every part of Asia, and not one province had shaken off the yoke. Even India, the most remote of Alexander's conquests, quietly submitted to Pytho the son of Agenor, and afterwards to Seleucus, who successively obtained dominion over that part of Asia. Porus and Taxiles, notwithstanding the death of their benefactor, neither declined submission to the authority of the Macedonians nor made any attempt to recover independence."

With the death of Alexander fell also the glory of the Macedonians; who very soon relapsed into a situation as bad, or worse, than that in which they had been before the reign of Philip. This was occasioned principally by his not having distinctly named a successor, and having no child of his own come to the years of discretion to whom the kingdom might seem naturally to belong. The ambition and jealousy of his mother Olympias, his queen Roxana, and especially of the great commanders of his army, not only prevented a successor from being ever named, but occasioned the death of every person, whether male or female, who was in the least related to Alexander. To have a just notion of the origin of these disturbances, it is necessary in the first place to understand the situation of the Macedonian affairs at the time of Alexander's death.

When Alexander set out for Asia, he left Antipater, as we formerly observed, in Macedon, to prevent any disturbances that might arise either there or in Greece. The Greeks, even during the lifetime of Alexander, bore the superiority which he exercised over them with great impatience; and, though nothing could be more

174
Causes of
the
diffusion of
his
empire.

Macedon.

gentle than the government of Antipater, yet he was exceedingly hated, because he obliged them to be quiet. One of the last actions of Alexander's life set all Greece in a flame. He had, by an edict, directed all the cities of Greece to recall their exiles; which edict, when it was published at the Olympic games, created much confusion. Many of the cities were afraid, that, when the exiles returned, they would change the government; most of them doubted their own safety if the edict took place; and all of them held this peremptory decree to be a total abolition of their liberty. No sooner therefore did the news of Alexander's death arrive than they prepared for war.

In Asia the state of things was not much better; not indeed through any inclination of the conquered countries to revolt, but through the dissensions among the commanders.—In the general council which was called soon after the death of Alexander, after much confusion and altercation, it was at last agreed, or rather commanded by the soldiers, that Aridæus the brother of Alexander, who had always accompanied the king, and had been wont to sacrifice with him, should assume the sovereignty.—This Aridæus was a man of very slender parts and judgment, not naturally, but by the wicked practices of Olympias, who had given him poisonous draughts in his infancy, left he should stand in the way of her son Alexander or any of his family; and for this, or some other reason, Perdiccas, Ptolemy, and most of the horse-officers, resented his promotion to such a degree, that they quitted the assembly, and even the city. However, Meleager, at the head of the phalanx, vigorously supported their first resolution, and threatened loudly to shed the blood of those who affected to rule over their equals, and to assume a kingdom which no way belonged to them. Aridæus was accordingly arrayed in royal robes, had the arms of Alexander put upon him, and was saluted by the name of *Philip*, to render him more popular. Thus were two parties formed, at the head of whom were Meleager and Perdiccas; both of them pretending vast concern for the public good, yet, at bottom, desiring nothing more than their own advantage. Perdiccas was a man of high birth, had a supreme command in the army, was much in favour with Alexander, and one in whom the nobility had put great confidence. Meleager was become formidable by having the phalanx on his side, and having the nominal king entirely in his power: for Aridæus, or Philip, was obliged to comply with whatever he thought proper; and publicly declared, that whatever he did was by the advice of Meleager; so that he made his minister accountable for his own schemes, and no way endangered himself. The Macedonians also, besides their regard for the deceased king, soon began to entertain a personal love for Philip on account of his moderation.

It is remarkable, however, that notwithstanding all the favours which Alexander had conferred upon his officers, and the fidelity with which they had served him during his life, only two of them were attached to the interests of his family after his death. These were Antipater and Eumenes the Cardian, whom he had appointed his secretary. Antipater, as we have already seen, was embroiled with the Greeks, and could

not assist the royal family who were in Asia; and Eumenes had not as yet sufficient interest to form a party in their favour. In a short time, however, Perdiccas prevailed against Meleager, and got him murdered, by which means the supreme power for a time fell in, and the empire divided. His first step, in consequence of this power, was to distribute the provinces of the empire among the commanders in the following manner, in order to prevent competitors, and to satisfy the ambition of the principal commanders of the army. Ariæus, and the son of Roxana, born after the death of his father, were to enjoy the regal authority. Antipater had the government of the European provinces. Craterus had the title of *protector*. Perdiccas was general of the household troops in the room of Hephestion. Ptolemy the son of Lagos had Egypt, Libya, and that part of Arabia which borders upon Egypt. Cleomenes, a man of infamous character, whom Alexander had made receiver-general in Egypt, was made Ptolemy's deputy. Leonceon had Syria; Philotas, Cilicia; Pithon, Media; Eumenes, Cappadocia, Paphlagonia, and all the country bordering on the Euxine Sea, as far as Trapezus; but these were not yet conquered, so that he was a governor without a province. Antigonus had Pamphylia, Lycia, and Phrygia Major; Cassander, Caria; Menander, Lydia; Leonatus, Phrygia on the Hellespont.

In the mean time, not only Alexander's will, but Alexander himself, was so much neglected, that his body was allowed to remain seven days before any notice was taken of it, or any orders given for its being embalmed. The only will he left was a short memorandum of fix things he would have done.—
1. The building of a fleet of 1000 stout galleys, to be made use of against the Carthaginians and other nations who should oppose the reduction of the sea-coasts of Africa and Spain, with all the adjacent islands as far as Sicily. 2. A large and regular highway was to be made along the coast of Africa, as far as Ceuta and Tangier. 3. Six temples of extraordinary magnificence were to be erected at the expence of 1500 talents each. 4. Castles, arsenals, havens, and yards for building ships, to be settled in proper places throughout his empire. 5. Several new cities were to be built in Europe and Asia; those in Asia to be inhabited by colonies from Europe, and those in Europe to be filled with Asiatics; that, by blending their people and their manners, that hereditary antipathy might be eradicated which had hitherto subsisted between the inhabitants of the different continents. 6. Lastly, he had projected the building of a pyramid, equal in bulk and beauty to the biggest in Egypt, in honour of his father Philip. All these designs, under pretence of their being expensive, were referred to a council of Macedonians, to be held nobody knew when or where.

The government, being now in the hands of Perdiccas and Roxana, grew quickly very cruel and distasteful. Alexander was scarce dead when the queen sent for Statira and Drypetis, the two daughters of Darius, one of whom had been married to Alexander, and the other to Hephestion; but as soon as they were arrived at Babylon, caused them both to be murdered, that no son of Alexander by any other woman, or of Hephestion, might give any trouble to her or her son Alexander.

115
Aridæus
appointed
king.

116
A party
formed
by Meleager,
and another by
Perdiccas.

118
Alexander's
body
neglected,
and his will
set aside.

119
The daughters
of Darius put
to death
Roxana.

Macedon. Alexander. Sygambis, the mother of Darius, no sooner heard that Alexander the Great was dead, than she laid violent hands on herself, being apprehensive of the calamities which were about to ensue.

120 War was first declared in Greece against Antipater in the year 321 B. C. Through the treachery of the Thebians, that general was defeated, with the army he had under his own command. Leonatus was therefore sent from Asia, with a very considerable army, to his assistance; but both were overthrown with great loss by the confederates, and Leonatus himself was killed. In a short time, however, Craterus arrived in Greece with a great army, the command of which he resigned to Antipater. The army of the confederates amounted to 25,000 foot and 3000 horse; but Antipater commanded no fewer than 40,000 foot, 3000 archers, and 5000 horse. In such an unequal contest, therefore, the Greeks were defeated, and forced to sue for peace; which they did not obtain but on condition of their receiving Macedonian garrisons into several of their cities. At Athens also the democratic government was abrogated; and such a dreadful punishment did this seem to the Athenians, that 22,000 of them left their country, and retired into Macedon.

121 While these things were doing in Greece, disturbances began also to arise in Asia and in Thrace. The Greek mercenaries, who were dispersed through the inland provinces of Asia, despairing of ever being allowed to return home by fair means, determined to attempt it by force. For this purpose, they assembled to the number of 20,000 foot and 3000 horse; but were all cut off to a man by the Macedonians. In Thrace, Lyfmachus was attacked by one Seuthes, a prince of that country who claimed the dominions of his ancestors, and had raised an army of 20,000 foot and 8000 horse. But though the Macedonian commander was forced to engage this army with no more than 4000 foot and 2000 horse, yet he kept the field of battle, and could not be driven out of the country. Perdiccas, in the mean time, by pretending friendship to the royal family, had gained over Eumenes entirely to his interest; and at last put him in possession of the province of Cappadocia by the defeat of Ariarathes king of that country, whom he afterwards cruelly caused to be crucified. His ambition, however, now began to lead him into difficulties. At the first division of the provinces, Perdiccas, to strengthen his own authority, had proposed to marry Niæxa the daughter of Antipater; and so well was this proposal relished, that her brethren Jollas and Archias conducted her to him, in order to be present at the celebration of the nuptials. But Perdiccas now had other things in view. He had been solicited by Olympias to marry her daughter Cleopatra, the widow of Alexander king of Epirus, and who then resided at Sardis in Lydia. Eumenes promoted this match to the utmost of his power, because he thought it would be for the interest of the royal family; and his persuasions had such an effect on Perdiccas, that he was sent to Sardis to compliment Cleopatra, and to carry presents to her in name of her new lover. In the absence of Eumenes, however, Alcetas, the brother of Perdiccas, persuaded him to marry Niæxa; but, in order to gratify his ambition, he resolved to divorce her immediately after marriage, and marry Cleopatra. By this

Macedon. last marriage, he hoped to have a pretence for altering the government of Macedon; and, as a necessary measure preparative to these, he entered into contrivances for destroying Antigonus. Unfortunately for himself, however, he ruined all his schemes by his own jealousy and precipitate cruelty. Cyane, the daughter of Philip by his second wife, had brought her daughter named *Adda*, and who was afterwards named *Eurydice*, to court, in hopes that king Aridæus might marry her. Against Cyane, Perdiccas, on some political motives, conceived such a grudge, that he caused her to be murdered. This raised a commotion in the army; which frightened Perdiccas to such a degree, that he now promoted the match between Aridæus and Eurydice; to prevent which, he had murdered the mother of the young prince. But, in the mean time, Antigonus, knowing the designs of Perdiccas against himself, fled with his son Demetrius to Greece, there to take shelter under the protection of Antipater and Craterus, whom he informed of the ambition and cruelty of the regent.

122 A civil war was now kindled. Antipater, Craterus, Neoptolemus, and Antigonus, were combined against Perdiccas; and it was the misfortune of the empire in general, that Eumenes, the most able general, as well as the most virtuous of all the commanders, was on the side of Perdiccas, because he believed him to be in the interest of Alexander's family. Ptolemy, in the mean time, remained in quiet possession of Egypt; but without the least intention of owning any person for his superior; however, he also acceded to the league formed against Perdiccas; and thus the only person in the whole empire who consulted the interest of the royal family was Eumenes.

123 It was now thought proper to bury the body of Alexander, which had been kept for two years, during all which time preparations had been making for it. Aridæus, to whose care it was committed, set out from Babylon for Damascus, in order to carry the king's body to Egypt. This was fore against the will of Perdiccas; for it seems there was a superstitious report, that wherever the body of Alexander was laid, that country should flourish most. Perdiccas, therefore, out of regard to his native soil, would have it conveyed to the royal sepulchres in Macedon; but Aridæus, pleading the late king's express direction, was determined to carry it into Egypt, from thence to be conveyed to the temple of Jupiter Ammon. —The funeral was accordingly conducted with all imaginable magnificence. Ptolemy came to meet the body as far as Syria; but, instead of burying it in the temple of Jupiter Ammon, erected a stately temple for it in the city of Alexandria; and, by the respect he showed for his dead master, induced many of the Macedonian veterans to join him, and who were afterwards of the greatest service to him.

No sooner was the funeral over, than both the parties above mentioned fell to blows. Perdiccas marched against Ptolemy; but was slain by his own men, who, after the death of their general, submitted to his antagonist; and thus Eumenes was left alone to contend against all the other generals who had served under Alexander. In this contest, however, he was by no means have been overmatched, had his soldiers

Macedon. been attached to him; but as they had been accustomed to serve under those very generals against whom they were now to fight, they were on all occasions ready to betray and desert Eumenes. However, he defeated and killed Neoptolemus and Craterus, but then found himself obliged to contend with Antipater and Antigonus. Antipater was now appointed protector of the kings, with sovereign power; and Eumenes was declared a public enemy. A new division

126
A new division of the empire

of Alexander's empire took place. Egypt, Libya, and the parts adjacent, were given to Ptolemy because they could not be taken from him. Syria was confirmed to Leomedon. Philoxenus had Cilicia. Mesopotamia and Arbelitis were given to Amphimachus. Babylon was bestowed on Seleucus. Susiana fell to Antigones, who commanded the Macedonian *Argyraspide* or *Silver Shields*, because he was the first who opposed Perdicas. Peucestas held Persia. Cleopolemus had Carmania. Pithon had Media as far as the Caspian Straits. Stafander had Aria and Drangia. Philip, Parthia. Stafonor, Bactria and Sogdia. Sybirtius, Aracopia. Oxartes, the father of Roxana, Parapomis. Another Pithon had the country between this province and India. Porus and Taxiles held what Alexander had given them, because they would not part with any of their dominions. Cappadocia was assigned to Nicanor. Phrygia Major, Lycæonia, Pamphylia, and Lycia, were given to Antigonus. Caria to Cassander, Lydia to Clytus, Phrygia the Less to Aridaeus. Cassander was appointed general of the horse; while the command of the household troops was given to Antigonus, with orders to prosecute the war against Eumenes.—Antipater having thus settled every thing as well as he could, returned to Macedon with the two kings, to the great joy of his countrymen, having left his son Cassander to be a check upon Antigonus in Asia.

Matters now seemed to wear a better aspect than they had yet done; and, had Eumenes believed that his enemies really consulted the interest of Alexander's family, there is not the least doubt that the war would have been immediately terminated. He saw, however, that the design of Antigonus was only to set up for himself, and therefore he refused to submit. From this time, therefore, the Macedonian empire creased in Asia; and an account of the transactions of this part of the world fall to be recorded under the article SYRIA. The Macedonian affairs are now entirely confined to the Kingdom of Macedon itself, and to Greece.

Antipater had not long been returned to Macedon, when he died; and the last action of his life completed the ruin of Alexander's family. Out of a view to the public good, he had appointed Polyperchon, the eldest of Alexander's captains at hand, to be *protector* and *governor* of Macedon. This failed not to disgust his son Cassander; who thought he had a natural right to these offices, and of course kindled a new civil war in Macedon. This was indeed highly promoted by his first actions as a governor. He began with attempting to remove all the governors appointed in Greece by Antipater, and to restore democracy wherever it had been abolished. The immediate consequence of this was, that the people refused to obey their magistrates; the governors refused to resign their places,

and applied for assistance to Cassander. Polyperchon also had the imprudence to recall Olympias from Epirus, and allow her a share in the administration; which Antipater, and even Alexander himself, had always refused her. The consequence of all this was, that Cassander invaded Greece, where he prevailed against Polyperchon: Olympias returned to Macedon, where she cruelly murdered Aridaeus and his wife Eurydice; she herself was put to death by Cassander, who afterwards caused Roxana and her son to be murdered, and Polyperchon being driven into Etolia, first raised to the crown Hercules the son of Alexander by the daughter of Darius, and then by the instigation of Cassander murdered him, by which means the line of Alexander the Great became totally extinct.

Cassander having thus destroyed all the royal family, assumed the regal title, as he had for 16 years before had all the power. He enjoyed the title of *king of Macedon* only three years; after which he died, about 293 B. C. By Thessalonica, the daughter of Philip king of Macedon, he left three sons, Philip, Antipater, and Alexander. Philip succeeded him, but soon after died of a consumption. A contest immediately began between the two brothers, Antipater and Alexander. Antipater seized the kingdom; and to secure himself in it, murdered his mother Thessalonica, if not with his own hand, at least the execrable fact was committed in his presence. Alexander invited Pyrrhus king of Epirus, and Demetrius the son of Antigonus, to assist him and revenge the death of his mother. But Pyrrhus being bought off, and a peace concluded between the brothers, Alexander, being afraid of having too many protectors, formed a scheme of getting Demetrius assassinated. Instead of this, however, both he and Antipater were put to death; and Demetrius became king of Macedon four years after the death of Cassander.

In 287 B. C. Demetrius was driven out by Pyrrhus, who was again driven out by Lysimachus two years after, who was soon after killed by Seleucus Nicator; and Seleucus, in his turn, was murdered by Ptolemy Cerasus, who became king of Macedon about 280 B. C. The new king was in a short time cut off, with his whole army, by the Gauls; and Antigonus Gonatus, the son of Demetrius Poliorcetes, became king of Macedon in 278 B. C. He proved successful against the Gauls, but was driven out by Pyrrhus king of Epirus; who, however, soon disoblige his subjects to such a degree, that Antigonus recovered a great part of his kingdom. But in a little time, Pyrrhus being killed at the siege of Argos in Greece, Antigonus was restored to the whole of Macedon; but scarcely was he seated on the throne, when he was driven from it by Alexander the son of Pyrrhus. This new invader was, in his turn, expelled by Demetrius the son of Antigonus; who, though at that time but a boy, had almost made himself master of Epirus. In this enterprise, however, he was disappointed; but by his means Antigonus was restored to his kingdom, which he governed for many years in peace. By a stratagem he made himself master of the city of Corinth, and from that time began to form schemes for the thorough conquest of Greece. The method he took to accomplish this was, to support the petty tyrants of Greece against the free states: which indeed weakened the power of

Macedon.

128
Various revolutions in the government.

127
Total destruction of Alexander's family.

Macedon. the latter; but involved the whole country in so many calamities, that these transactions could not redound much to the reputation either of his arms or his honour. About 243 B. C. he died, leaving the kingdom to his son, Demetrius II.

129
War with
the Ro-
mans.

Neither Demetrius, nor his successor Antigonus Dōson, performed any thing remarkable. In 221 B. C. the kingdom fell to Philip, the last but one of the Macedonian monarchs. To him Hannibal applied for assistance after the battle of Cannæ, which he refused; and the same imprudence which made him refuse this assistance prompted him to embroil himself with the Romans; and at last to conclude a treaty with them, by which he in effect became their subject, being tied up from making peace or war but according to their pleasure. In 179 B. C. he was succeeded by his eldest son Perſes, under whom the war with the Romans was renewed. Even yet the Macedonians were terrible in war; and their phalanx, when properly conducted, seems to have been absolutely invincible by any method of making war known at that time. It consisted of 16,000 men, of whom 1000 marched abreast, and thus

was 16 men deep, each of whom carried a kind of pike 23 feet long. The soldiers stood so close, that the pikes of the fifth rank reached their points beyond the front of the battle. The hindermost ranks leaned their pikes on the shoulders of those who went before them, and, locking them fast, pressed briskly against them when they made the charge; so that the first five ranks had the impetus of the whole phalanx, which was the reason why the shock was generally irresistible. The Romans had never encountered such a terrible enemy; and in the first battle, which happened 171 B. C. they were defeated with the loss of 2200 men, while the Macedonians lost no more than 60. The generals of Perſes now pressed him to storm the enemy's camp; but he being naturally of a cowardly disposition refused to comply, and thus the best opportunity he ever had was lost. Still, however, the Romans gained little or no advantage, till the year 168 B. C. when Paulus Æmilius, a most experienced commander, was sent into Macedon. Perſes now put all upon the issue of a general engagement; and Æmilius, with all his courage and military experience, would have been defeated, had the Macedonians been commanded by a general of the smallest courage or conduct. The light armed Macedonians charged with such vigour, that after the battle, some of their bodies were found within two furlongs of the Roman camp. When the phalanx came to charge, the points of their spears striking into the Roman shields, kept the heavy armed troops from making any motion; while, on the other hand, Perſes's light-armed men did terrible execution. On this occasion, it is said, that Æmilius tore his clothes, and gave up all hopes. However, perceiving that as the phalanx gained ground it lost its order in several places, he caused his own light-armed troops to charge in those places, whereby the Macedonians were soon put into confusion. If Perſes with his horse had on the first appearance of this charged the Romans briskly, his infantry would have been able to recover themselves; but instead of this, he betook himself to flight, and the infantry at last did the same, but not till 20,000 of them had lost their lives.

This battle decided the fate of Macedonia, which immediately submitted to the conqueror. The coward-

ly king took refuge in the island of Samothrace; but was at last obliged to surrender to the Roman consul, by whom he was carried to Rome, led in triumph, and afterwards most barbarously used. Some pretenders to the throne appeared afterwards; but being unable to defend themselves against the Romans, the country was reduced to a Roman province in 148 B. C. To them it continued subject till the year 137, when it was reduced by the Turkish sultan Bajazet, and hath remained in the hands of the Turks ever since.

MACEDONIANS, in ecclesiastical history, the followers of Macedonius, bishop of Constantinople, who, through the influence of the Eunomians, was deposed by the council of Constantinople in 360, and sent into exile. He considered the Holy Ghost as a divine energy diffused throughout the universe, and not as a person distinct from the Father and the Son. The sect of Macedonians was crushed before it had arrived at its full maturity, by the council assembled by Theodosius in 381, at Constantinople. See **SEMI-ARIANS**.

MACERONIUS. See **MACEDONIANS**.

MACER (**EMILIUS**), an ancient Latin poet, was born at Verona, and flourished under Augustus Cæsar. Eusebius relates, that he died a few years after Virgil. Ovid speaks of a poem of his, on the nature and quality of birds, serpents, and herbs; which he says Macer being then very old had often read to him:

*Sæpe juas volucres legiti mihi grandior ævo,
Quaque nocet serpens, quæ juvat herba, Macer.
De Ponto, lib. iv. eleg. 10.*

There is extant a poem upon the nature and power of herbs under Macer's name; but it is spurious. He also wrote a supplement to Homer, as Quintus Calaber did afterwards in Greek:

*Tu canis æterna quicquid restabat Homero:
Ne curant summa Troica bella manu.
De Ponto, lib. ii. eleg. 12.*

MACERATION, is an infusion of, or soaking ingredients in water or any other fluid, in order either to soften them or draw out their virtues.

MACERATA, a handsome and populous town of Italy, in the territory of the church, and in the Marche of Ancona, with a bishop's see, and an university. It is seated near the mountain Cliento, in E. Long. 13. 37. N. Lat. 43. 15.

MACHAON, a celebrated physician among the ancients, son of Æsculapius and brother to Podalirius. He went to the Trojan war with the inhabitants of Trica, Ithome, and Æchalia. According to some, he was king of Messenia. He was physician to the Greeks, and healed the wounds which they received during the Trojan war. Some suppose he was killed before Troy by Eurypylus the son of Telephus. He received divine honours after death, and had a temple in Messenia.

MACHÆRUS (anc. geog.), a citadel on the other side Jordan, near the mountains of Moab, not far from and to the north of the *Lacus Asphaltites*. It was the south boundary of the Perææ: situated on a mountain encompassed round with deep and broad valleys; built by Alexander king of the Jews, destroyed by Gabinius in the war with Aristobulus, and rebuilt by Herod with a cognominal town round it. Here John the Baptist was beheaded (Josephus).

MACHIAN,

* Macedo-
nians
||
Machærus.

130
Macedonia
becomes a
Roman
province.

MACHIAN, one of the Molucca islands, in the East Indian Ocean, about 20 miles in circumference, and the most fertile of them all. It likewise produces the best cloves; and is in possession of the Dutch, who have three strong forts built on it.

MACHIAVEL (Nicholas), a famous political writer of the 16th century, was born of a distinguished family at Florence. He wrote in his native language with great elegance and politeness, though he understood very little of the Latin tongue; but he was in the service of Marcellus Virgilius, a learned man, who pointed out to him many of the beautiful passages in the ancients, which Machiavel had the art of placing properly in his works. He composed a comedy upon the ancient Greek model; in which he turned into ridicule many of the Florentine ladies, and which was so well received, that Pope Leo X. caused it to be acted at Rome. Machiavel was secretary, and afterwards historiographer, to the republic of Florence. The house of Medici procured him this last office, together with a handsome salary, in order to pacify his resentment for having suffered the torture upon suspicion of being an accomplice in the conspiracy of the Soderini against that house, when Machiavel bore his sufferings without making any confession. The great encomiums he bestowed upon Brutus and Cæsius, both in his conversations and writings, made him strongly suspected of being concerned in another conspiracy against cardinal Julian de Medici, who was afterwards pope under the name of *Clement VII.* However, they carried on no proceedings against him; but from that time he turned every thing into ridicule, and gave himself up to irreligion. He died in 1530, of a remedy which he had taken by way of prevention.—Of all his writings, that which has made the most noise, and has drawn upon him the most enemies, is a political treatise entitled the *Prince*; which has been translated into several languages, and wrote against by many authors. The world is not agreed as to the motives of this work; some thinking, he meant to recommend tyrannical maxims; others, that he only delineated them to excite abhorrence. Machiavel also wrote, *Reflections on Titus Livius*, which are extremely curious; *The History of Florence*, from the year 1205 to 1494; and a quarto volume of *Poems* and other pieces. Mr Harrington considers him as a superior genius, and as the most excellent writer on politics and government that ever appeared.

MACHINE, (*Machina*), in the general, signifies any thing that serves to augment or to regulate moving powers: Or it is any body destined to produce motion, so as to save either time or force. The word comes from the Greek *μηχανή*, “machine, invention, art.” And hence, in strictness, a machine is something that consists more in art and invention, than in the strength and solidity of the materials; for which reason it is that the inventors of machines are called *ingenieurs* or *engineers*.

Machines are either simple or compound. The simple ones are the seven mechanical powers, viz. lever, balance, pulley, axis and wheel, wedge, screw, and inclined plane. See **MECHANICS**.

From these the compound ones are formed by various combinations, and serve for different purposes. See

MECHANICS and **HYDROSTATICS**; also the articles **A-Machinery**, **AGRICULTURE**, **CANNON**, **CENTRIFUGAL**, **FIRE**, **STEAM**, **FURNACE**, **BURROUGHS**, **RAMSDEN**, &c. &c.

MACHINES used in war amongst the Greeks, were principally these: 1. *Κλίμακας*, or scaling ladders; 2. The battering ram; 3. The *belopai*; 4. The *χελων* or tortoise, called by the Romans *testudo*; 5. The *χαμα* or *agger*, which was faced with stone, and raised higher than the wall; 6. Upon the *χαμα* were built *πύργοι* or towers of wood; 7. *Γέρραι*, or osier hurdles; 8. *Catapulse*, or *καταπύλαι*, from which they threw arrows with amazing force; and, 9. The *λιθοβολοί*, *πιτροβολοί*, or *αρκύβητες*, from which stones were cast with great velocity.

The principal warlike machines made use of by the Romans were, the ram, the *lupus* or wolf, the *testudo* or tortoise, the *ballista*, the *catapulta*, and the *scorpion*.

MACHINERY, in epic and dramatic poetry, is when the poet introduces the use of machines; or brings some supernatural being upon the stage, in order to solve some difficulty or to perform some exploit out of the reach of human power.

The ancient dramatic poets never made use of machines, unless where there was an absolute necessity for so doing: whence the precept of Horace;

Nec Deus interfit, nisi dignus vindice nodus Inciderit.

It is quite otherwise with epic poets, who introduce machines in every part of their poems; so that nothing is done without the intervention of the gods. In Milton's *Paradise Lost*, by far the greater part of the actors are supernatural personages: Homer and Virgil do nothing without them; and, in Voltaire's *Henriade*, the poet has made excellent use of St Louis.

As to the manner in which these machines should act, it is sometimes invisibly, by simple inspirations and suggestions; sometimes by actually appearing under some human form; and, lastly, by means of dreams and oracles, which partake of the other two. However, all these should be managed in such a manner as to keep within the bounds of probability.

MACHUL, an instrument of music among the ^{Plate} Hebrews. Kircher apprehends that the name was ^{CCLXXIX} given to two kinds of instruments, one of the stringed and the other of the pulsatile kind. That of the former sort had six chords: though there is great reason to doubt whether an instrument requiring the aid of the hair-bow, and so much resembling the violin, be so ancient. The second kind was of a circular form, made of metal, and either hung round with little bells, or furnished with iron rings suspended on a rod or bar that passed across the circle. Kircher supposes that it was moved to and fro by a handle fixed to it, and thus emitted a melancholy kind of murmur.

MACHYNLETH, a town of Montgomeryshire in North Wales, 198 miles from London, and 32 from Montgomery. It is an ancient town; and has a market on Mondays, and fairs on May 16, June 26, July 9, September 18, and November 25, for sheep, horned cattle, and horses. It is situated on the river Douay, over which there is a large stone bridge, which leads into Merionethshire. It was here that Owain Glyndwr exercised the first acts of his royalty in 1402. Here

Mackenzie, Here he accepted the crown of Wales, and assembled a parliament; and the house wherein they met is now standing, divided into tenements.

MACKENZIE, (Sir George), an able lawyer, a polite scholar, and a celebrated wit, was born at Dundee in the county of Angus in Scotland in 1636, and studied at the universities of Aberdeen and St Andrew's; after which he applied himself to the civil law, travelled into France, and prosecuted his study in that faculty for about three years. At his return to his native country, he became an advocate in the city of Edinburgh; and soon gained the character of an eminent pleader. He did not, however, suffer his abilities to be confined entirely to that province. He had a good taste for polite literature; and he gave the public, from time to time, incontestable proofs of an uncommon proficiency therein. He had practised but a few years, when he was promoted to the office of a judge in the criminal court; and, in 1674, was made king's advocate, and one of the lords of the privy council in Scotland. He was also knighted by his majesty. In these stations he met with a great deal of trouble, on account of the rebellions which happened in his time; and his office of advocate requiring him to act with severity, he did not escape being censured, as if in the deaths of some particular persons who were executed he had stretched the laws too far. But there does not seem to have been any just foundation for this clamour against him; and it is generally agreed, that he acquitted himself like an able and upright magistrate. Upon the abrogation of the penal laws by king James II. our advocate, though he had always been remarkable for his loyalty, and even censured for his zeal against traitors and fanatics, thought himself obliged to resign his post; being convinced, that he could not discharge the duties of it in that point with a good conscience. But he was soon after restored, and held his offices till the revolution; an event which, it seems, he could not bring himself to approve. He had hoped that the prince of Orange would have returned to his own country when matters were adjusted between the king and his subjects; and upon its proving otherwise, he quitted all his employments in Scotland, and retired into England, resolving to spend the remainder of his days in the university of Oxford. He arrived there in September 1689, and prosecuted his studies in the Bodleian library, being admitted a student there by a grace passed in the congregation, June 2. 1690. In the spring following, he went to London; where he fell into a disorder, of which he died in May 1691. His corpse was conveyed by land to Scotland, and interred there with great pomp and solemnity. "The politeness of his learning, and the sprightliness of his wit, were (says the reverend Mr Granger) conspicuous in all his pleadings, and shone in his ordinary conversation." Mr Dryden acknowledges, that he was unacquainted with what he calls the *beautiful turn of words and thoughts in poetry*, till they were explained and exemplified to him in a conversation with that noble wit of Scotland Sir George Mackenzie.—He wrote several pieces of history and antiquities; Institutions of the laws of Scotland; Essays upon various subjects, &c. His works were printed together at Edinburgh in 1716, in 2 vols folio.

MACKEREL, in ichthyology. See SOMMER.

MACKEY (John), an Englishman, employed by the government as a spy upon James II. after the revolution, was author of Memoirs of James's court at St Germaine, and of the court of England in the reigns of William III. and queen Anne; in which are many curious anecdotes not to be met with in any other work. He died in 1726.

MACLAURIN (Colin), a most eminent mathematician and philosopher, was the son of a clergyman, and born at Kilmoddan in Scotland in 1668. He was sent to the university of Glasgow in 1709; where he continued five years, and applied himself to study in a most intense manner. His great genius for mathematical learning discovered itself so early as at twelve years of age; when, having accidentally met with an Euclid in a friend's chamber, he became in a few days master of the first six books without any assistance; and it is certain, that in his 16th year he had invented many of the propositions which were afterwards published under the title of *Geometria organica*. In his 17th year he took the degree of master of arts; on which occasion he composed and publicly defended a thesis On the power of Gravity, with great applause. After this he quitted the university, and retired to a country-seat of his uncle, who had the care of his education; for his parents had been dead some time. Here he spent two or three years in pursuing his favourite studies; but, in 1717, he offered himself a candidate for the professorship of mathematics in the Marischal college of Aberdeen, and obtained it after a ten days trial with a very able competitor. In 1719, he went to London, where he became acquainted with Dr Hoadly then bishop of Bangor, Dr Clarke, Sir Isaac Newton, and other eminent men; at which time also he was admitted a member of the Royal Society; and in another journey in 1721, he contracted an intimacy with Martin Folkes, Esq. the president of it, which lasted to his death.

In 1722, lord Polwarth, plenipotentiary of the king of Great-Britain at the congress of Cambray, engaged him to go as a tutor and companion to his eldest son, who was then to set out on his travels. After a short stay at Paris, and visiting other towns in France, they fixed in Lorrain; where Maclaurin wrote his piece On the Percussion of Bodies, which gained the prize of the royal academy of sciences for the year 1724. But his pupil dying soon after at Montpellier, he returned immediately to his profession at Aberdeen. He was hardly settled here, when he received an invitation to Edinburgh; the curators of that university being desirous that he should supply the place of Mr James Gregory, whose great age and infirmities had rendered him incapable of teaching. He had some difficulties to encounter, arising from competitors, who had good interest with the patrons of the university, and also from the want of an additional fund for the new professor; which however at length were all surmounted, principally by the means of Sir Isaac Newton. In Nov. 1725, he was introduced into the university; as was at the same time his learned colleague and intimate friend, Dr Alexander Morro, professor of anatomy. After this, the mathematical classes soon became very numerous, there being generally upwards of 100 young gentlemen attending his lectures every year; who being of different standings and proficiency, he

was obliged to divide them into four or five classes, in each of which he employed a full hour every day, from the first of November to the first of June.

He lived a bachelor to the year 1733: but being not less formed for society than for contemplation, he then married Anne, the daughter of Mr Walter Stewart solicitor-general to his late majesty for Scotland. By this lady he had seven children, of whom two sons and three daughters, together with his wife, survived him. In 1734, Berkeley, bishop of Cloyne, published a piece called "The Analyst;" in which he took occasion, from some disputes that had arisen concerning the grounds of the fluxionary method, to explode the method itself, and also to charge mathematicians in general with infidelity in religion. Maclaurin thought himself included in this charge, and began an answer to Berkeley's book: but, as he proceeded, so many discoveries, so many new theories and problems occurred to him, that instead of a vindictory pamphlet, his work came out, A complete system of Fluxions, with their application to the most considerable problems in geometry and natural philosophy. This work was published at Edinburgh in 1742, 2 vols 4to; and as it cost him infinite pains, so it is the most considerable of all his works, and will do him immortal honour. In the mean time, he was continually obliging the public with some performance or observation of his own; many of which were published in the fifth and sixth volumes of the "Medical Essays" at Edinburgh. Some of them were likewise published in the Philosophical Transactions; as the following: 1. Of the construction and measure of curves, N° 356. 2. A new method of describing all kinds of curves, N° 359. 3. A letter to Martin Folkes, Esq; on equations with impossible roots, May 1726, N° 394. 4. Continuation of the same, March 1729, N° 408. 5. December the 21st, 1732, on the description of curves; with an account of farther improvements, and a paper dated at Nancy, Nov. 27, 1722, N° 439. 6. An account of the treatise of fluxions, Jan. 27, 1742, N° 467. 7. The same continued, March 10, 1742, N° 469. 8. A rule for finding the meridional parts of a spheroid with the same exactness as of a sphere, August 1741, N° 461. 9. Of the basis of the cells wherein the bees deposit their honey; Nov. 3. 1734. N° 471.

In the midst of these studies, he was always ready to lend his assistance in contriving and promoting any scheme which might contribute to the service of his country. When the earl of Morton set out in 1739 for Orkney and Shetland, to visit his estates there, he desired Mr Maclaurin to assist him in settling the geography of those countries, which is very erroneous in all our maps; to examine their natural history, to survey the coasts, and to take the measure of a degree of the meridian. Maclaurin's family affairs, and other connections, would not permit him to do this: he drew, however, a memorial of what he thought necessary to be observed, furnished the proper instruments, and recommended Mr Short, the famous optician, as a fit operator for the management of them. He had still another scheme for the improvement of geography and navigation, of a more extensive nature; which was the opening a passage from Greenland to the South Sea by the north pole. That such a pas-

N° 190.

sage might be found, he was so fully persuaded, that he has been heard to say, if his situation could admit of such adventures, he would undertake the voyage, even at his own charge. But when schemes for finding it were laid before the parliament in 1741, and himself consulted by several persons of high rank concerning them, before he could finish the memorials he proposed to send, the premium was limited to the discovery of a North-west passage: and he used to regret, that the word West was inserted, because he thought that passage, if at all to be found, must lie not far from the pole.

In 1745, having been very active in fortifying the city of Edinburgh against the rebel army, he was obliged to fly from thence to the north of England; where he was invited by Herring, then archbishop of York, to reside with him during his stay in this country. In this expedition, however, being exposed to cold and hardships, and naturally of a weak and tender constitution, he laid the foundation of an illness which put an end to his life, in June 1746, at the age of 48.

Mr Maclaurin was a very good as well as a very great man, and worthy of love as well as admiration. His peculiar merit as a philosopher was, that all his studies were accommodated to general utility; and we find, in many places of his works, an application even of the most abstruse theories, to the perfecting of mechanical arts. He had resolved, for the same purpose, to compose a course of practical mathematics, and to rescue several useful branches of the science from the bad treatment they often met with in less skilful hands. But all this his death prevented; unless we should reckon, as a part of his intended work, the translation of Dr David Gregory's "Practical Geometry," which he revised, and published with additions, 1745. In his lifetime, however, he had frequent opportunities of serving his friends and his country by his great skill. Whatever difficulty occurred concerning the constructing or perfecting of machines, the working of mines, the improving of manufactures, the conveying of water, or the execution of any other public work, he was at hand to resolve it. He was likewise employed to terminate some disputes of consequence that had arisen at Glasgow concerning the gauging of vessels; and for that purpose presented to the commissioners of excise two elaborate memorials, with their demonstrations, containing rules by which the officers now act. He made also calculations relating to the provision, now established by law, for the children and widows of the Scots clergy, and of the professors in the universities, intitling them to certain annuities and sums, upon the voluntary annual payment of a certain sum by the incumbent. In contriving and adjusting this wise and useful scheme, he bestowed a great deal of labour, and contributed not a little towards bringing it to perfection. It may be said of such a man, that "he lived to some purpose;" which can hardly be said of those, how uncommon soever their abilities and attainments, who spend their whole time in abstract speculations, and produce nothing to the real use and service of their fellow creatures.

Of his works, we have mentioned his *Geometria Organica*, in which he treats of the description of curve lines by continued motion. We need not repeat what

has

Mackenzie has been said concerning his piece which gained the prize of the royal academy of sciences in 1724. In 1740, the academy adjudged him a prize, which did him still more honour, for solving the motion of the tides from the theory of gravity; a question which had been given out the former year, without receiving any solution. He had only ten days to draw this paper up in, and could not find leisure to transcribe a fair copy; so that the Paris edition of it is incorrect. He afterwards revised the whole, and inserted it in his Treatise of Fluxions; as he did also the substance of the former piece. Theft, with the Treatise of Fluxions, and the pieces printed in the Philosophical Transactions, of which we have given a list, are all the writings which our author lived to publish. Since his death, two volumes more have appeared; his Algebra, and his Account of Sir Isaac Newton's Philosophical Discoveries. His Algebra, though not finished by himself, is yet allowed to be excellent in its kind; containing, in no large volume, a complete elementary treatise of that science, as far as it has hitherto been carried. His Account of Sir Isaac Newton's Philosophy was occasioned in the following manner: Sir Isaac dying in the beginning of 1728, his nephew, Mr Conduitt, proposed to publish an account of his life, and desired Mr Maclaurin's assistance. The latter, out of gratitude to his great benefactor, cheerfully undertook, and soon finished, the history of the progress which philosophy had made before Sir Isaac's time, and this was the first draught of the work in hand; which not going forward, on account of Mr Conduitt's death, was returned to Mr Maclaurin.—To this he afterwards made great additions, and left it in the state in which it now appears. His main design seems to have been, to explain only those parts of Sir Isaac's philosophy which have been, and still are, controverted: and this is supposed to be the reason why his grand discoveries concerning light and colours are but transiently and generally touched upon. For it is known, that ever since the experiments, on which his doctrine of light and colours is founded, have been repeated with due care, this doctrine has not been contested; whereas his accounting for the celestial motions, and the other great appearances of nature, from gravity, is misunderstood, and even ridiculed by some to this day.

MACQUER (Philippe), advocate of the parliament of Paris, where he was born in 1720, being descended from a respectable family. A weakness in his lungs having prevented him from engaging in the laborious exercises of pleading, he dedicated himself to literary pursuits. His works are, 1. *L'Abregé Chronologique de l'Histoire Ecclesiastique*, 3 vols. 8vo, written in the manner of the President Henault's History of France, but not possessed of equal spirit and elegance. 2. *Les Annales Romaines*, 1756, 8vo; another chronological abridgement, and much better supported than the former. Into this work the author has introduced every thing most worthy of notice which has been written by Saint Evremond, Abbé Saint-Real, President Montequieu, Abbé Mably, &c. concerning the Romans; and, if we except a difference of style, which is easily discernible, it is, in other respects, a very judicious compilation. 3. *Abregé Chronologique de l'Histoire d'Espagne*. Vol. X. Part I.

Et de Portugal, 1759, 1765, in two vols. 8vo. This book, in point of accuracy, is worthy of the President Henault, by whom it was begun; but it displays no discrimination of character nor depth of research. The author received assistance from M. Lacombe, whose talents for chronological abridgement are well known. The republic of letters sustained a loss by the death of M. Macquer, which happened on the 27th of January 1770, at the age of 50. As to his character, he was industrious, agreeable, modest, and sincere, and an enemy to all foolish vanity and affectation. He had a cold imagination, but a correct taste. He had an eager thirst for knowledge of every kind, and he had neglected no useful branch of study. He had a share in the Dictionary of Arts and Professions, in 2 vols 8vo, and in the Translation of the Syphilis of Fracastor published by Lacombe.

MACQUER (Pierre Joseph), brother to the former, was born at Paris the 9th of October 1718, and died there February 16th 1784. He was a member of the academy of sciences, and late professor of pharmacy; and was engaged in the *Journal des Savans*, for the articles of medicine and chemistry. With the latter science he was intimately acquainted. He had a share in the *Pharmacopœia Parisiensis*, published in 1758, in 4to. His other works are, 1. *Elements de Chimie theorique*; Paris, 1749, 1753, 12mo; which have been translated into English and German.—2. *Elements de Chimie pratique*, 1751, 2 vols. 12mo. These two works were re-published together, in 1756, in 3 vols 12mo. 3. *Plan d'un cours de Chimie experimentale & raisonnée*, 1757, 12mo; in the composition of which he was associated with M. Beaumé. 4. *Formule Medicamentorum Magistralium*, 1763. 5. *L'Art de la Teinture en Soie*, 1763.—6. *Dictionnaire de Chimie, contenant la théorie & la pratique de cet art*, 1766, 2 vols 8vo; which has been translated into German, with notes; and into English, with notes, by Mr Keir. Macquer has, by his labours and writings, greatly contributed to render useful an art which formerly tended only to ruin the health of the patient by foreign remedies, or to reduce the professors of it to beggary, while they prosecuted the idle dreams of converting every thing into gold.

MACRIN (Salmon), one of the best Latin poets of the 16th century, was born at Loudon. His true name was *John Salmon*; but he took that of *Macrin*, from his being frequently so called in ridicule by Francis I. on account of his extraordinary leanness. He was preceptor to Claudius of Savoy, count of Tende; and to Honorius the count's brother; and wrote several pieces of poetry in lyric verse, which were so admired, that he was called the *Horace of his time*. He died of old age, at Loudon, in 1555.—Charles MACRIN, his son, was not inferior to him as a poet, and surpassed him in his knowledge of the Greek tongue. He was preceptor to Catharine of Navarre, the sister of Henry the Great; and perished in the massacre on St Bartholomew's day in 1572.

MACROBII, a people of Ethiopia, celebrated for their justice, and the innocence of their manners: also a people in the island Merœe. The Hyperboreans were also called Macrobiani: They generally lived to their 120th year; and for their longevity they obtained their name (*μακρος βίος, long life.*)

Macrobius,
Macroce-
phalus.

MACROBIUS (Ambrosius Aurelius Theodosius), an ancient Latin writer, who flourished towards the latter part of the fourth century.—Of what country he was, is not clear: Erasmus, in his Ciceronianus, seems to think he was a Greek; and he himself tells us, in the preface to his *Saturnalia*, that he was not a Roman, but laboured under the inconveniences of writing in a language which was not natural to him. Of what religion he was, Christianity or Pagan, is uncertain. Barthius ranks him among the Christians; but Spanheim and Fabricius suppose him to have been a heathen. This, however, is certain, that he was a man of consular dignity, and one of the chamberlains or masters of the wardrobe to Theodosius; as appears from a rescript directed to Florentius, concerning those who were to obtain that office. He wrote a Commentary upon Cicero's *Somnium Scipionis*, and seven books of *Saturnalia*, which treat of various subjects, and are an agreeable mixture of criticism and antiquity. He was not an original writer, but made great use of other people's works, borrowing not only their materials, but even their language, and for this he has been satirically rallied by some modern authors, though rather unfairly, considering the express declaration and apology which he makes on this head, at the very entrance of his work. "Don't blame me," says he, "if what I have collected from multifarious reading, I shall frequently express in the very words of the authors from whom I have taken it: for my view in this present work is, not to give proofs of my eloquence, but to collect and digest into some regularity and order such things as I thought might be useful to be known. I shall therefore here imitate the bees, who suck the best juices from all sorts of flowers, and afterwards work them up into various forms and orders, with some mixture of their own proper spirit." The *Somnium Scipionis* and *Saturnalia* have been often printed; to which has been added, in the later editions, a piece intitled, *De Differentiis & Societatis Græci Latiniq; Verbi*.

MACROCEPHALUS, (compounded of *μακρος* "great," and *κεφαλη* "head," denotes a person with a head larger or longer than the common size. Macrocephali, or Long-heads, is a name given to a certain people, who, according to the accounts of authors, were famous for the uncommon length of their heads: yet custom so far habituated them to it, that instead of looking on it as a deformity, they esteemed it a beauty, and, as soon as the child was born, moulded and fashioned its head in their hands to as great a length as possible, and afterwards used all such rollers and bandages as might seem most likely to determine its growing long. The greater part of the islanders in the Archipelago, some of the people of Asia, and even some of those of Europe, still press their childrens heads out lengthwise. We may observe also, that the Epirotes, many people of America, &c. are all born with some singularity in the conformation of their heads; either a flatness on the top, two extraordinary protuberances behind, or one on each side; singularities which we can only regard as an effect of an ancient and strange mode, which at length is become hereditary in the nation. According to the report of many travellers, the operation of compressing the head of a child lengthwise, while it is yet soft, is with a view in-
finitely to enlarge the interval between the two eyes, so

that the visual rays turning more to the right and left, the sight would embrace a much larger portion of the horizon; the advantage of which they are well acquainted with, either in the constant exercise of hunting, or on a thousand other occasions. Ever since the 16th century, the missionaries established in the countries inhabited by the savages of America, have endeavoured to destroy this custom; and we find in the sessions of the third council of Lima, held in 1585, a canon which expressly prohibits it. But if it has been repressed one way, the free negroes and Maroons, although Africans, have adopted it, since they have been established among the Caribs, solely with the view of distinguishing their children, which are born free, from those who are born in slavery. The Omaguas, a people of South America, according to P. Veigh, press the heads of their children so violently between two planks that they become quite sharp at the top, and flat before and behind. They say they do this to give their heads a greater resemblance to the moon.

MACROCERCI, a name given to that class of animalcules which have tails longer than their bodies.

MACROCOLUM, or **MACROCOLLUM** (formed of *μακρος* "large," and *κολακος* "I join,") among the Romans, the largest kind of paper then in use. It measured sixteen inches, and frequently two feet.

MACROCOSM, a word denoting the great world or universe. It is compounded of the Greek words *μακρος* "great," and *κοσμος* "world."

MACROOMP, or **MACROOM**, a town of Ireland, in the barony of Muskerry, county of Cork, and province of Munster, 142 miles from Dublin; it is situated amongst hills, in a dry gravelly limestone soil.—This place is said to take its name from an old crooked oak, so called in Irish, which formerly grew here. The castle was first built in King John's time, soon after the English conquest, (according to Sir Richard Cox) by the Carews, but others attribute it to the Daltons. It was repaired and beautified by Teague Macarty, who died in the year 1565, and was father to the celebrated Sir Cormac Mac Teague mentioned by Camden and other writers as an active person in Queen Elizabeth's time. The late Earls of Glancarty altered this castle into a more modern structure, it being burnt down in the wars of 1641. Opposite to the bridge, is the parish-church, dedicated to St Colman of Cloyne. Here is a barrack for a foot company, a market-house, and handsome Roman Catholic chapel. A considerable number of persons have been employed in this town in combing wool and spinning yarn, and some salt-works have been erected here. At half a mile's distance is a spa, that rises on the very brink of a bog; its waters are a mild chalybeate, and are accounted serviceable in hypochondriacal cases, and in eutaneous eruptions. The fairs are four in the year.

MACROPYRENIUM, in natural history, a genus of fossils consisting of crustated septaria, with a long nucleus standing out at each end of the mass.

MACROTELOSTYLA, in natural history, the name of a genus of crystals, which are composed of two pyramids joined to the end of a column; both the pyramids, as also the column, being hexangular, and

Madatio and the whole body consequently composed of 18 planes.

MACTATIO, in the Roman sacrifices, signifies the act of killing the victim. This was performed either by the priest himself, or some of his inferior officers, whom we meet with under the names of *pope, agones, cultarii, and victimarii*; but, before the beast was killed, the priest, turning himself to the east, drew a crooked line with his knife, from the forehead to the tail. Among the Greeks, this ceremony was performed most commonly by the priest, or, in his absence, by the most honourable person present. If the sacrifice was offered to the celestial gods, the victim's throat was bent up towards heaven; if to the infernal, or to heroes, it was killed with its throat towards the ground. The manner of killing the animal was by a stroke on the head, and, after it was fallen, thrusting a knife into its throat. Much notice was taken, and good or ill success predicted, from the struggles of the beast, or its quiet submission to the blow, from the flowing of the blood, and the length of time it happened to live after the fall, &c.

MACULÆ, in astronomy, dark spots appearing on the luminous surfaces of the sun and moon, and even some of the planets. See **ASTRONOMY**, n° 30. and n° 58 *et seq.* and n° 98. and n° 121 *et seq.*

MAD-APPLE. See **SOLANUM**.

MADAGASCAR, the largest of the African islands, is situated between 43° and 51° of E. Long. and between 12° and 26° of S. Lat.; extending in length near 100 miles from north-north-east to south-south-west, and about 300 in breadth where broadest. It was discovered in 1506 by Laurence Almeyda; but the Persians and the Arabians were acquainted with it from time immemorial under the name of *Serandib*. Alphonzo Albuquerque ordered Ruy Pereira dy Conthinto to visit the interior parts, and that general intrusted Trifan d'Acunha with the survey. The Portuguese called it the island of *St Laurence*; the French, who visited it in the reign of Henry IV. named it *Ile Dauphine*; its proper name is *Madagafce*. It is now, however, by common consent, called *Madagascar*.

This large island, according to many learned geographers, is the Cerné of Pliny, and the Menuthiadé of Ptolemy. It is every where watered by large rivers, streams, and rivulets, which have their source at the foot of that long chain of mountains which runs thro' the whole extent of the island from east to west. The two highest promontories are called *Vivagora* and *Bo-tifimene*.

These mountains (according to the Abbe Rochon*) inclose within their bosoms a variety of precious minerals and useful fossils. The traveller (who for the first time rambles over savage and mountainous countries, intersected with valleys and with hills, where nature left to herself brings forth the most singular and the most varied productions) is involuntarily surpris'd and terrified at the sight of precipices, the summits of which are crowned with monstrous trees, that seem coeval with the world. His astonishment is redoubled at the noise of those grand cascades, the approach to which is generally inaccessible. But to those views so sublimely picturesque, rural scenes soon succeed; little hills, gentle rising grounds, and plains, the vegetation

of which is never repressed by the intemperance or the vicissitude of the seasons. The eye contemplates with pleasure those vast savannas which nourish numberless herds of bellocks and of sheep. You behold a flourishing agriculture, produced almost solely by the fertilizing womb of nature. The fortunate inhabitants of Madagascar do not bedew the earth with their sweat; they scarce stir the ground with a rake, and even that slight preparation is sufficient. They scrape little holes at a small distance from each other, into which they scatter a few grains of rice, and cover them with their feet; and so great in the fertility of the soil, that the lands sown in this careless manner produce an hundred fold.

The forests present a prodigious variety of the most useful and the most beautiful trees; ebony, wood for dying, bamboos of an enormous thickness, and palm trees of every kind. The timber employed in ship-building is no less common than those kinds so much prized by the cabinet-maker. We are told by the French governor Flacourt, in his history of this island†, that in the year 1650 he sent to France 52,000 weight of aloes of an excellent quality. All of these various trees and shrubs are surrounded by an infinite number of parasitical plants: mushrooms of an infinite diversity of kinds and colours are to be met with every where in the woods; and the inhabitants know well how to distinguish those which are prejudicial to the health. They collect large quantities of useful gums and resins; and out of the milky sap of a tree, denominated by them *singuiore*, the inhabitants, by means of coagulation, make that singular substance known to naturalists by the name of *gum elastic*. (See **CAOUTCHOUC** and **JATROPHA**.)

Besides the aromatic and medicinal herbs which abound in the forests, the island produces flax and hemp of a length and strength which surpass any in Europe. Sugar canes, wax, honey of different kinds, tobacco, indigo, white pepper, gum-lac, ambergris, silk, and cotton, would long since have been objects of commerce which Madagascar would have yielded in profusion, if the Europeans, in visiting the island, had furnished the inhabitants with the necessary information for preparing and improving these several productions.

The sugar-canes (as we are informed by another traveller§) are much larger and finer than any in the west || *Terr's*, Indies; being as thick as a man's wrist, and so full of juice, that a foot of them will weigh two pounds. When the natives travel, they carry a sugar-cane along with them, which will support them for two or three days. Here are also plenty of tamarinds; and such quantities of limes and oranges, that very large calks may be filled with their juices at a trifling expence, as they may be purchased for iron-pots, muskets, powder, ball, &c. During the short time that Admiral Wat-son's squadron staid here in 1754, Mr Ives preserved about half a hoghead full of those juices, which proved afterwards of the greatest service to the ships crews. It must be observed, however, that no good water is to be had at St Augustine in the south-west part of the island, where ships usually touch, unless boats are sent for it four or five miles up the river; and instead of filling their calks at low water (as is the case in most other rivers), they must begin to fill at about

Madagaf-
car.

† *Hist. de la
Grand Isle
de Madaga-
Paris 1660.*

* *Voyage à
Madagaf-
car, &c.
Par. 1791.*

|| *Terr's*,
Indies, p. 140.

Madagascar.

about a quarter's flood: The reason assigned for this is, that the river has a communication with the sea at other places besides this of St Augustine's bay; and it has been found by experience, that the sea-water brought into the river by the flood-tide is not discharged till a quarter's flood of the next tide in St Augustine's bay; and for three miles up the river, the water is always very brackish, if not quite salt.

The abundance and variety of provisions of every kind, which a fine climate and fertile soil can produce, are on no part of the globe, according to M. Rochon, superior to those of Madagascar: game, wild-fowl, poultry, fish, cattle, and fruits, are alike plentiful. The oxen, Mr Ives also informs us, are large and fat, and have each a protuberance of fat between the shoulders, weighing about 20 pounds. Their flesh is greatly esteemed by all the European nations trading to India, and ships are sent to Madagascar on purpose to kill and salt them on the island. The protuberance of fat above mentioned is particularly esteemed after it has lain some time in salt; but our author says, that he could not join in the encomiums either on this piece or the beef in general; as the herbage on which the creatures feed gives their flesh a particular taste, which to him was disagreeable. The sheep differ little from the goats; being equally hairy, only that their heads are somewhat larger: their necks resemble that of a calf, and their tails weigh at least ten pounds. Vast quantities of locusts rise here from the low lands in thick clouds, extending sometimes to an incredible length and breadth. The natives eat these insects, and even prefer them to their finest fish. Their method of dressing them is to strip off their legs and wings, and fry them in oil.

The inhabitants (termed *Melagaches* or *Madecassies*), M. Rochon informs us, are in person above the middle size of Europeans. The colour of the skin is different in different tribes: among some it is of a deep black, among others tawny; some of the natives are of a copper colour, but the complexion of by far the greatest number is olive. All those who are black have woolly hair like the negroes of the coast of Africa: those, on the other hand, who resemble Indians and Mulattoes, have hair equally straight with that of the Europeans; the nose is not broad and flat; the forehead is large and open; in short, all the features are regular and agreeable. Their physiognomy displays the appearance of frankness and of satisfaction: they are desirous only of learning such things as may administer to their necessities; that species of knowledge which demands reflection is indifferent to them; sober, agile, active, they spend the greatest part of their time either in sleep or in amusement. In fine, according to the Abbé, the natives of Madagascar, like savages in general, possess a character equally devoid of vice and of virtue; the gratifications of the present moment solely occupy his reflections; he possesses no kind of foresight whatever; and he cannot conceive the idea that there are men in the world who trouble themselves about the evils of futurity.

The population of the island has been estimated at four millions; but this calculation is thought exaggerated by our author, and indeed it appears incredible to us. Every tribe or society inhabits its own canton, and is governed by its own customs. Each of

Madagascar.

these acknowledges a chief; this chief is sometimes elective, but more usually hereditary. The lands are not divided and portioned out, but belong to those who are at the trouble of cultivating them. These islanders make use of neither locks nor keys; the principal part of their food consists in rice, fish, and flesh; their rice is moistened with a soup which is seasoned with pimento, ginger, saffron, and aromatic herbs. They display wonderful cunning in catching a variety of birds, many of which are unknown in Europe: they have the pheasant, the partridge, the quail, the pintado, the wild duck, teal of five or six different kinds, the blue hen, the black parrot, and the turtle-dove, in great plenty; and also a bat of a monstrous size, which is much prized on account of its exquisite flavour. Their last are so hideous in their appearance, that they at first terrify the European sailors; but after they have vanquished their repugnance to them, they prize their flesh infinitely before that of the pullets of their own country. The Melagaches also catch an immense quantity of sea-fish; such as the dorado, the sole, the herring, the mackerel, the turtle, &c. with oysters, crabs, &c. The rivers afford excellent eels, and mullets of an exquisite flavour.

The inhabitants near St Augustine's bay, Mr Ives informs us, speak as much broken English as enables them to exchange their provisions for European articles. These, on the part of the Melagaches, are cattle, poultry, milk, fruit, rice, salt, porcelain, potatoes, yams, fish, lances, and shells. From the Europeans they receive muskets, powder, bullets, flints, cloaths, (including handkerchiefs, and linen of all kinds), beads, iron pots, &c.—Silver, which they call *Manilla*, is in great esteem with them, and is made by them into bracelets for their wives.

That part of the island at which the English squadron touched, is the dominions of the king of *Baba*, who, by the account of Mr Ives, seemed greatly to affect to be an Englishman. They had no sooner touched at the island, than they were waited on by one called *Robin Hood*, and another person, both of whom bore the office of *purfers*. Along with these were *Philbey* the general; John Anderson and Frederic Martin, captains. Nor did the king himself and his family disdain to pay them a visit; who, in like manner, were distinguished by English names; the king's eldest son being called the prince of Wales, and the court not being without a duke of Cumberland, a prince Angustus, princesses, &c. as in England. All these grandes came on board naked, excepting only a slight covering about their loins and on their shoulders, made of a kind of grafs growing on the island; which they had adorned with small glass beads by way of border or fringe. Their hair resembled that of the Indians in being long and black, rather than the woolly heads of the African negroes. "The wives of the Melagaches (according to our author) take great pains with their husbands hair; sometimes putting it in large and regular curls; at other times braiding it in great order, and making it shine with a particular oil which the island produces. The men always carry in their hands a wooden lance headed with iron, which is commonly made very neat; and they are such excellent marksmen, that they will strike with it a very small

Madag-
car.

small object at 30 or 40 yards distance. They have also commonly a miket, which they get from Europeans in exchange for cattle, and are always free to keep in excellent order. I am sorry to say (continues Mr Ives) that the English are frequently guilty of great impositions in this kind of traffic, by disposing of cheap and ill-tempered barrels among the poor inhabitants, who sometimes lose their lives by the bursting of these pieces. Such iniquitous practices as these must in the end prove injurious to the nation; and has indeed already made the name of more than one half of these traders truly infamous among the deluded but hitherto friendly Madagascarians.

"They are a civil and good-natured people, but easily provoked, and apt to show their resentment on the least provocation, especially when they think themselves injured or slighted. Another characteristic of them is, the very high notions of dignity they entertain of their king; which is carried to such a height, that they are never more sensibly hurt than when they imagine he is treated with incivility or disrespect. This mighty monarch resides in a town built with mud, about 12 miles up the country from St Augustine's Bay. On the east side of the bay, as you enter, there resided one Prince William, a relation and tributary to the king; but who in most cases acted as an independent prince, and always used his utmost endeavours with the officers to cause them buy their provisions from him, and not from the king or his subjects. In this prince's territories, not far from the sea, are the remains of a fort built by Avery the Pirate.

"All the women of Madagascar, excepting the very poorest sort, wear a covering over their breasts and shoulders, ornamented with glass beads, and none go without a cloth about their loins. They commonly walk with a long slender rod or stick. The men are allowed to marry as many women as they can support.

"During our stay at this island (says Mr Ives), I observed, with great concern, several miserable objects in the last stage of the venereal disease. They had not been able to find any cure; and as far as I could learn, their doctors are totally ignorant of medicine. The only method they use for curing all distempers, as well external as internal, is the wearing on the arm or neck a particular charm or amulet; or befouling the part affected with earth moistened with the juice of some plant or tree, and made up into a soft paste.

"I took some pains to learn their religious tenets; and find that they worship one Universal Father; whom, when they speak in English, they call God; and in whom they conceive all kinds of perfection to reside. The sun they look upon as a glorious body; and, I believe, as a spiritual being, but created and dependent. They frequently look up to it with wonder, if not with praise and adoration. They make their supplications to the One Almighty, and offer sacrifices to him in their distresses. I had the curiosity to attend a sacrifice, at the hut of John Anderson, whose father had for a long time been afflicted with sickness. About sun-set an ox was brought into the yard; and the son, who officiated as priest, slew it. An altar was reared nigh, and the post of it was sprinkled with the blood of the victim. The head,

Madag-
car.

after its being severed from the body, was placed, with the horns on, at the foot of the altar: the caud was burned on the fire, and most of the pluck and entrails boiled in a pot. The sick man, who was brought to the door, and placed on the ground so as to face the sacrifice, prayed often, and seemingly with great fervency. His eyes were fixed attentively towards the heavens, and his hands held up in a supplicating posture. The ceremony ended with the son's cutting up the ox into small pieces; the greatest part of which he distributed among the poor slaves belonging to his father and himself; reserving, however, some of the best pieces for his own use. Upon the whole, I saw so many circumstances in this Madagascarian sacrifice, so exactly resembling those described in the Old Testament as offered up by the Jews, that I could not turn my thoughts back to the original, without being sensibly struck by the exactness of the copy."

When the Squadron first arrived at Madagascar, the king of Baba, a man of about 60 years of age, was ill of the gout. Having demanded of admiral Watfon some presents, the latter complimented him, among other things, with some brandy. The monarch then asked him if he had any doctor with him, and if he was a great doctor, and a king's doctor? To all which being answered in the affirmative, he desired him to bring some *mahomets* (medicines) for his sick knee. With this requisition Mr Ives designed to comply; but having waited until some officers should be ready to accompany him, his majesty, in the mean time, took such a dose of brandy as quickly sent the gout into his head, and occasioned his death. Mr Ives observes, that it happened very luckily for him that the monarch's decease happened without his having taken any of the medicines intended for him, as it would have been impossible to avoid the imputation of having poisoned him, which would certainly have been refuted by his loyal subjects.

The king's death occasioned great confusion; the grandes being desirous that it should be concealed for some time. This, however, was found impossible; on which they set off for the *Mud Town* about 11 o'clock the same evening. All the inhabitants of the village followed their example; leaving only the dogs, who set up the most hideous howling. Captain Frederic Martin coming to take leave of the English, begged with great earnestness for a fresh supply of gun-powder; whispering that the king was dead, and that they should in all probability go to war about making another. They had been formerly told, that one who had the title of *duke* of Baba would certainly succeed to the throne; but they afterwards learned, that Philibey the general having espoused the cause of *Raphani* the late king's son, and taken him under his tutelage and protection, this youth, who was only about 16 years of age, succeeded his father as king of Baba.

The following is a description of the southern division of the island, from the Abbé Rochon.

"That part of Madagascar in which fort Dauphin is situated is very populous. Almost all the villages are placed on eminences, and surrounded with two rows of strong palisades, somewhat in the manner of such of our fences as are composed of hurdles and turf. Within, is a parapet of solid earth about four feet in height;

Madaga-
car.

height; large pointed bamboos placed at the distance of five feet from each other, and sunk in a pit, form a kind of loop-holes, which contribute towards the defence of these villages, some of which are besides fortified with a ditch ten feet in breadth and six in depth. The dwelling of the chief is called a *donac*. When the chiefs go abroad, they are always provided with a musket and a stick armed with iron, and adorned at the extremity with a little tuft of cow's hair. They wear a bonnet of red wool. It is chiefly by the colour of their bonnet that they are distinguished from their subjects. Their authority is extremely limited; however, in the province of *Carcanoffi*, the lands by custom belong to their chiefs, who distribute them among their subjects for the purposes of cultivation; they exact a trifling quit-rent in return, which in their language is called *faanfa*.—The people of Carcanoffi are not altogether ignorant of the art of writing; they even possess some historical works in the Madagascar tongue: but their learned men, whom they term *Ombiafas*, make use of the Arabic characters alone. They have treatises on medicine, geomancy, and judicial astrology; the most renowned live in the province of *Matatane*: it is in that district that magic still remains in all its glory; the *Matanes* are actually dreaded by the other Madagascans on account of their excellence in this delusive art. The *Ombiafas* have public schools in which they teach geomancy and astrology. The natives have undoubtedly learned the art of writing from the Arabians, who made a conquest of this island about 300 years since.

“The people of the province of *Anessfi*, near fort Dauphin, are lively, gay, sensible, and grateful; they are passionately fond of women; are never melancholy in their company; and their principal occupation is to please the sex: indeed, whenever they meet their wives, they begin to sing and dance. The women, from being happy, are always in good humour. Their lively and cheerful character is extremely pleasing to the Europeans. I have often been present at their assemblies, where affairs of importance have been agitated; I have observed their dances, their sports, and their amusements, and I have found them free from those excesses which are but too common among polished nations. Indeed I was too young at this time for my observations to be of much weight: but if my experience be insufficient to inspire confidence, I beg the reader will rather consider the nature of things, than the relations given by men without principles or intelligence, who fancy that they have a right to tyrannize over the inhabitants of every country which they can subdue. If the people of Madagascar have sometimes availed themselves of treachery, they have been forced to it by the tyranny of the Europeans. The weak have no other arms against the strong. Could they defend themselves by any other means from our artillery and bayonets? They are uninformed and helpless; and we avail ourselves of their weakness, in order to make them submit to our covetousness and caprice. They receive the most cruel and oppressive treatment, in return for the hospitality which they generously bestow on us; and we call them traitors and cowards, when we force them to break the yoke with which we have been pleased to load them.”

In the second volume of Count Benyowsky's Me-

moirs and Travels we have the following account of the religion, government, &c. of the people of this island.

Madagas-
car.

“The Madagascar nation believe in a Supreme Being, whom they call *Zanbare*, which denotes creator of all things. They honour and revere this Being; but have dedicated no temple to him, and much less have they substituted idols. They make sacrifices, by killing oxen and sheep, and they address all these libations to God. It has been asserted, that this nation likewise makes offerings to the devil: but in this there is a deception; for the piece of the sacrificed beast which is usually thrown into the fire is not intended in honour of the devil, as is usually pretended. This custom is very ancient, and no one can tell the true reason of it. With regard to the immortality of the soul, the Madagascar people are persuaded, that, after their death, their spirit will return again to the region in which the *Zanbare* dwells; but they by no means admit that the spirit of man, after his death, can suffer any evil. As to the distinction of evil or good, they are persuaded that the good and upright man shall be recompensed, in this life, by a good state of health, the constancy of his friends, the increase of his fortunes, the obedience of his children, and the happiness of beholding the prosperity of his family: and they believe that the wicked man's fate shall be the contrary to this. The Madagascar people, upon this conviction, when they make oaths, add benedictions in favour of those who keep them, and curses against those who break them. In this manner it is that they appeal to the judgment of *Zanbare*, in making agreements; and it has never been known, or heard of, that a native of Madagascar has broken his oath, provided it was made in the usual manner, which they say was prescribed by their forefathers.

“As to their kings and form of government, &c. The Madagascar people have always acknowledged the line of *Ramini*, as that to which the rights of *Ampanfakabe* or sovereign belongs. They have considered this line as extinct since the death of *Dian Ramini Larizon*, which happened 66 years ago, and whose body was buried upon a mountain, out of which the river *Manangourou* springs; but having acknowledged the heir of this line on the female side, they re-established this title in the year 1776. The right of the *Ampanfakabe* consists in nominating the *Rohandrians* to assist in the cabars, at which all those who are cited are bound to appear, and the judgment of the *Ampanfakabe* in his cabar is decisive. Another prerogative of the *Ampanfakabe* is, that each *Rohandrian* is obliged to leave him by will a certain proportion of his property, which the successors usually purchase by a slight tribute or fine. Thirdly, the *Ampanfakabe* has a right to exact from each *Rohandrian* one tenth of the produce of his land, and a number of horned cattle and slaves, in proportion to the riches of the country possessed by each *Rohandrian*.—The second order is composed of the *Rohandrians*, or princes. Since the loss of the *Ampanfakabe*, three of these *Rohandrians* have assumed the title of *kings*, namely the *Rohandrian* of the province of *Mahavelou*, named *Hiaviv*; of the province of *Voemar*, named *Lambouin*; and a third at *Bombetoki*, named *Cimounounpou*. The third order consists of the *Voadziri*, or lords of a district, composed

composed of several villages. The fourth order consists of the Lohavohits, or chiefs of villages. The fifth order, Odzatzzi, who are freemen, and compose the attendants or followers of the Rohandrians, Voadziri, or Lohavohits. The sixth order consists of Ombiaffes, or learned men; and this order forms the warriors, workmen, physicians, and diviners: these last possess no charge. The seventh order consists of Anpurias or slaves.

"Having made inquiries from Bombetoki passing to the northward, and as far as Itapere, the result proved that there are 38 Rohandrians actually reigning, and 287 Voadziri. With respect to the Lohavohits, Ondzatzzi, and Ombiaffes, it was not possible to obtain any accurate determination of their number. These orders preserve a regular gradation, respecting which it would be very difficult to give a detailed account. They live in the manner we read of concerning the ancient patriarchs. Every father of a family is priest and judge in his own house, though he depends upon the Lohavohits, who superintend his conduct. This last is answerable to his Voadziri, and the Voadziri to the Rohandrian.

"The Madagascar people having no communication with the main land of Æthiopia, have not altered their primitive laws; and the language throughout the whole extent of the island is the same. It would be a rash attempt to determine the origin of this nation; it is certain that it consists of three distinct races, who have for ages past formed intermixtures which vary to infinity. The first race is that of Zafe Ibrahim, or descendants of Abraham; but they have no vestige of Judaism, except circumcision, and some names, such as Isaac, Reuben, Jacob, &c. This race is of a brown colour.—The second race is that of Zafaramini: with respect to this, some books which are still extant among the Ombiaffes, affirm, that it is not more than six centuries since their arrival at Madagascar.—With respect to the third race of Zafe Canambou, it is of Arabian extraction, and arrived much more lately than the others from the coasts of Æthiopia: hence it possesses neither power nor credit, and fills only the charges of writers, historians, poets, &c.

"In regard to arts and trades, the Madagascar nation are contented with such as are necessary to make their moveables, tools, utensils, and arms for defence; to construct their dwellings, and the boats which are necessary for their navigation; and lastly, to fabricate cloths and stuffs for their clothing. They are desirous only of possessing the necessary supplies of immediate utility and convenience. The principal and most respected business, is the manufacture of iron and steel. The artists in this way call themselves *ampansa viba*. They are very expert in fusing the ore, and forging utensils, such as hatchets, hammers, anvils, knives, spades, sagayes, razors, pincers, or tweezers for pulling out the hair, &c. The second class consists of the goldsmiths (*ampansa vola mena*): they cast gold in ingots, and make up bracelets, buckles, ear-rings, drops, rings, &c. The third are called *ampavollanga*, and are potters. The fourth are the *ampanevatta*, or turners in wood, who make boxes called *vatta*, plates, wooden and horn spoons, bive-hives, coffins, &c. The fifth, *ompan cacafoin*, or carpenters. They are very expert in this business, and make use of the rule, the

plane, the compasses, &c. The sixth are the *ompaniavi*, or rope-makers. They make their ropes of different kinds of bark of trees, and likewise of hemp. The seventh, *ompan lamba*, or weavers. This business is performed by women only, and it would be reckoned disgraceful in a man to exercise it. The *ombiaffes* are the literary men and physicians, who give advice only. The *berawois* are comedians and dancers.

"The Madagascar people always live in society; that is to say, in towns and villages. The towns are surrounded by a ditch and pallisades (as already mentioned), at the extremities of which a guard from 12 to 20 armed men is kept. The houses of private people consist of a convenient cottage, surrounded by several small ones: the master of the house dwells in the largest, and his women or slaves lodge in the smaller. These houses are built of wood, covered with leaves of the palm-tree or straw.

"The houses of the great men of the country are very spacious; each house is composed of two walls and four apartments: round about the principal house other smaller habitations are built for the accommodation of the women, and the whole family of the chief; but the slaves cannot pass the night within them. Most of the houses inhabited by the Rohandrians are built with taste and admirable symmetry."

The French attempted to conquer and take possession of the whole island, by order, and for the use of, their Most Christian Majesties, Louis XIII. and XIV. and they maintained a footing on it from the year 1642 to 1657. During this period, by the most cruel treachery, they taught the native princes the barbarous traffic in slaves, by villainously selling to the Dutch governor of Mauritius a number of innocent people, who had been assisting them in forming a settlement at Fort Dauphin.

The Abbé Rochon tells us, that the insalubrity of the air in Madagascar determined his countrymen in 1664 to quit that immense island, in order to establish themselves at so inconsiderable a place as the Isle of Bourbon, which is scarcely perceptible in a map of the globe: but it is apparent, from the account of the state of the French affairs on the island of Madagascar in 1661, when Flacourt's narrative was published, that their ill treatment of the natives had raised such a general and formidable opposition to their residence in the country, that the French were obliged to abandon their possessions for other reasons than the unhealthy qualities of the climate. We have not room here for a detail of all the oppressive measures of the French, which the Abbé himself candidly censures in the strongest terms; but shall extract the following narrative, both because it is interesting in itself, and exhibits the causes and the means of their expulsion.

La Cafe, one of the French officers employed by the governor of Fort Dauphin against the natives, was so successful in all his enterprises, that they called him *Deaan Pou*, the name of a chief who had formerly conquered the whole island. The French governor, jealous of his renown, treated him harshly, and refused to allow him the rank or honours due to his valour. The sovereign of the province of Anboule, called *Deaan Rakitai*, taking advantage of his discontent, prevailed on him to become his general. Five Frenchmen followed him. Deaan Nong, the daughter

Madagasc.
car.

ter of Rascat, captivated by the person and heroism of La Cafe, offered him her hand with the consent of her father. The chief, grown old, infirm, and arrived at the last stage of existence, had the satisfaction of securing the happiness of his subjects, by appointing his son-in-law absolute master of the rich province of Ambouille. La Cafe, in marrying Deaan Nong, refused to take the titles and honours attached to the sovereign power: he would accept of no other character, than that of the first subject of his wife, who was declared sovereign at the death of her father. Secure in the affection of this prince, who was not only possessed of personal charms, but of courage and great qualities, he was beloved and respected by her family, and by all the people of Ambouille, who revered him as a father; and yet, how much soever he wished it, he was unable to contribute to the prosperity of his countrymen at Fort Dauphin, whom he knew to be in the utmost distress. The governor, regarding him as a traitor, had set a price on his head, and on the heads of the five Frenchmen who had followed him. The neighbouring chiefs, irritated at this treatment of a man whom they so much venerated, unanimously refused to supply the fort with provisions. This occasioned a famine in the place, which, with a contagious fever and other maladies, reduced the French garrison to 80 men.

The establishment at Fort Dauphin, on the point of being totally destroyed, was preserved for a short time from ruin by the arrival of a vessel from France, commanded by Keradio an officer of Brittany, who, with the assistance of a young advocate who had been kidnapped on board the vessel, prevailed on the envious and implacable governor Chamargou, to make peace with La Cafe and his sovereign spouse Deaan Nong. This peace, however, lasted but for a short time; the French, restless and insolent to the neighbouring nations, again drew on them the vengeance of the natives. Even the few friends whom they had been able to acquire by means of La Cafe, were rendered hostile to them by the tyrannical zeal of the missionaries; who, not contented with being tolerated and allowed to make converts, insisted on Deaan Manang sovereign of Mandarary, a powerful, courageous, and intelligent chief, well-disposed to the French, to divorce all his wives but one. This prince, not convinced of the necessity of such a measure, assured them that he was unable to change his habits and way of living, which were those of his forefathers. "You would allow me (says he) to have one wife; but if the possession of one woman is a blessing, why should a numerous seraglio be an evil, while peace and concord reign among those of whom it is composed? Do you see among us any indications of jealousy or hatred? No, all our women are good; all try to make me happy; and I am more their slave than their master." This speech had no effect on father Stephen, superior of the Madagascar mission. He peremptorily ordered him instantly to repudiate all his wives except one; and threatened, in presence of the women, to have them taken from him by the French soldiers if he hesitated in complying with his commands. It is easy to imagine, says M. Rochon, with what indignation this language must have been heard

Madagasc.
car.
Madder.

in the *donac* or palace of this prince. The females failed the missionary on all sides; loaded him with execrations and blows; and, in their fury, would doubtless have afforded him no more quarter than the Thracian women did Orpheus, if Deaan Manang, notwithstanding his own agitation, had not made use of all his authority to save him.

In order to free himself from the persecution of this priest, he removed with his family 70 or 80 miles up into the country; but he was soon followed by Father Stephen and another missionary, with their attendants. The chief, Manang, still received them civilly; but he intreated them no longer to insist on the conversion of him and his people, as it was impossible to oblige them to quit the customs and manners of their ancestors. The only reply which Father Stephen made to this intreaty, was by tearing off the *ohs*, and the amulets and charms which the chief wore as sacred badges of his own religion; and, throwing them into the fire, he declared war against him and his nation. This violence instantly cost him and his followers their lives: they were all massacred by order of Manang, who vowed the destruction of all the French in the island; in which intention he proceeded in a manner that has been related by an eye-witness, who was afterwards provincial commissary of artillery, in a narrative published at Lyons in 1722, intitled *Voyage de Madagasc*. "Our yoke (says the Abbé Rochon) was become odious and insupportable. Hilitarians, for the honour of civilized nations, should bury in oblivion the afflicting narratives of the atrocities exercised on these people, whom we are pleased to call barbarous, treacherous, and deceitful, because they have revolted against European adventurers, whose least crime is that of violating the sacred rites of hospitality."

It was about the year 1672 that the French were totally driven from the island of Madagascar; and no considerable attempts were made to form fresh establishments there till within these few years, by M. de Modave, and by Count Benyowski; neither of which was attended with success, for reasons given by the Abbé, but which we have not room to detail.

MADDER. See RUBIA.

M. Macquer observes, that the Hollanders are obliged to the refugees from Flanders for the knowledge of manufacturing the root of madder; and that they generally cultivate it in fresh lands which have not been ploughed. The commodity, when manufactured, is distinguished into different kinds, as grape madder, bunch-madder, &c. The grape-madder is the heart of the root; the other, besides the heart, consists also of the bark and small fibres proceeding from the principal root. For that kind called *grape-madder*, the finest roots are picked out, the bark separated at the mill, and the inside root kept moist in *casks* for three or four years, which makes it more fit for dyeing than otherwise it would be. Unless madder be kept close in this manner, it is apt to spoil, and loses its bright colour in a great measure. It is yellow at first, but grows red and darker with age. It should be chosen of a fine saffron colour, in very hard lumps, and of a strong though not disagreeable smell.

The madder used for dyeing cottons in the East Indies, is in some respects different from that of Europe.

Madder,
Madeira,

Madeira,

rope. On the coast of Coromandel it has the name of *chat*, and grows wild on the coast of Malabar. The cultivated kind is imported from Vaur and Tucorin, but the most esteemed is the Persian chat called also *damas*. Another plant, called *raye de chaye*, or colour-root, is also gathered on the coast of Coromandel; but this, though supposed to be a species of madder, is a kind of *galium flore albo*, which, however, gives a tolerable good colour to cotton. Another species of madder, called *chine-boya*, and *chine-bazala*, is cultivated at Kunder in the neighbourhood of Smyrna, and some other countries of Turkey in Asia. It is more esteemed than the best Zealand madder imported into these parts by the Dutch; and experiments have shown that it is superior to any other kind as a dyeing ingredient. The modern Greeks call this kind of madder *lizari*, and the Arabs *fonyoy*. The fine colour of these madders, however, are by our author attributed to their being dried in the air, and not in stoves. Another kind of madder is produced in Canada, where it is called *tyssa-voyana*; its qualities are nearly the same with the European kind.

The root of madder impregates water with a dull red colour, and spirit of wine with a deep bright red. This root, when eat by animals along with their food, tinges their urine, and their most solid bones, of a deep red. Wool previously boiled in a solution of alum and tartar, receives from a hot decoction of madder and tartar, a very durable but not a very beautiful red colour. Mr Margraaf (Berlin Mem. 1771), shows how a very durable lake of a fine red colour, fit for the purposes of painting, may be obtained from madder. This process is as follows: Take two ounces of the purest Roman alum, and dissolve it in three French quarts of distilled water that has boiled, and in a clean glazed pot. Set the pot on the fire; and when the water begins to boil, withdraw it, and add two ounces of the best Dutch madder. Boil the mixture once or twice; then remove it from the fire, and filter it through a double filter of paper not coloured. Let the liquor thus filtrated stand a night to settle, and pour off the clear liquor into the glazed pot previously well cleaned. Make the liquor hot, and add to it gradually a clear solution of salt of tartar in water, till all the madder is precipitated. Filtrate the mixture; and upon the red precipitate which remains upon the filter pour boiling distilled water, till the water no longer acquires a saline taste. The red lake is then to be gently dried. No other water, neither rain nor river water, produces so good a colour as that which has been distilled, and the quantity required of this is considerable. The colour of the above precipitate is deep; but if two parts of madder be used to one part of alum, the colour will be still deeper: one part of madder and four parts of alum produces a beautiful rose colour.

MADEIRAS, a cluster of islands situated in the Atlantic ocean in W. Long. 16°, and between 32° and 33° N. Lat.—The largest of them, called *Madeira*, from which the rest take their name, is about 55 English miles long, and 10 miles broad; and was first discovered on the 2d of July, in the year 1419, by Joao Gonzales Zarco, there being no historical foundation for the fabulous report of its discovery by one Machin an Englishman. It is divided into two capi-

Vol. X. Part II.

tania, named *Funchal* and *Maxico*, from the towns of those names. The former contains two judicatures, viz. Funchal and Calhetta; the latter being a town with the title of a county, belonging to the family of Castello Melhor. The second capitania likewise comprehends two judicatures, viz. Maxico (read Malhico) and San Vicente.

Funchal is the only cidade or city in this island, which has also seven villas or towns; of which there are four, Calhetta, Camara de Lobos, Ribeira Braba, and Ponta de Sol in the capitania of Funchal, which is divided into 26 parishes. The other three are in the capitania of Maxico, which consists of 17 parishes; these towns are called *Maxico*, *San Vicente*, and *Santa Cruz*.

The governor is at the head of all the civil and military departments of this island, of Porto-Santo, the Salvages, and the Ilhas Desartas; which last only contain the temporary huts of some fishermen, who resort thither in pursuit of their business.

The law-department is under the corregidor, who is appointed by the king of Portugal, commonly sent from Lisbon, and holds his place during the king's pleasure. All causes come to him from inferior courts by appeal. Each judicature has a senate; and a *juiz* or judge, whom they choose, presides over them. At Funchal he is called *Juiz da Fora*; and in the absence, or after the death of the corregidor, acts as his deputy. The foreign merchants elect their own judges, called the *Procurador*, who is at the same time collector of the king's customs and revenues, which amount in all to about 12,000*l*. Sterling. Far the greatest part of this sum is applied towards the salaries of civil and military officers, the pay of troops, and the maintenance of public buildings. This revenue arises, first from the tenth of all the produce of this island belonging to the king, by virtue of his office as grand master of the order of Christ; secondly, from ten per cent. duties laid on all imports, provisions excepted; and lastly, from the eleven per cent. charged on all exports.

The island has but one company of regular soldiers of 100 men: the rest of the military force is a militia consisting of 3000 men, divided into companies, each commanded by a captain, who has one lieutenant under him and one ensign. There is no pay given to either the private men or the officers of this militia; and yet their places are much sought after, on account of the rank which they communicate. These troops are embodied once a year, and exercised once a month. All the military are commanded by the *Serjeante Mór*. The governor has two *Capitanes de Sal* about him, who do duty as aides-de-camp.

The secular priests on the island are about 1200, many of whom are employed as private tutors. Since the expulsion of the Jesuits, no regular public school is to be found here; unless we except a seminary, where a priest, appointed for that purpose, instructs and educates ten students at the king's expence. These wear a red cloak over the usual black gowns worn by ordinary students. All those who intend to go into orders, are obliged to qualify themselves by studying in the university of Coimbra, lately re-established in Portugal. There is also a dean and chapter at Madeira, with a bishop at their head, whose

Madeira's income is considerably greater than the governor's; it consists of 110 pipes of wine, and of 40 muids of wheat, each containing 24 bushels; which amounts in common years to 3000*l.* Sterling. Here are likewise 60 or 70 Franciscan friars, in four monasteries, one of which is at Funchal. About 300 nuns live on the island, in four convents, of the order of Merci, Sta. Clara, Incarnacao, and Bom Jesus. Those of the last mentioned institution may marry whenever they choose, and leave their monastery.

In the year 1768, the inhabitants living in the 43 parishes of Madeira, amounted to 63,913, of whom there were 31,341 males and 32,572 females. But in that year 5243 persons died, and no more than 2198 children were born; so that the number of the dead exceeded that of the born by 3045. It is highly probable that some epidemical distemper carried off so disproportionate a number in that year, as the island would shortly be entirely depopulated if the mortality were always equal to this. Another circumstance concurs to strengthen this supposition, namely, the excellence of the climate. The weather is in general mild and temperate: in summer, the heat is very moderate on the higher parts of the island, whither the better sort of people retire for that season; and in the winter the snow remains there for several days, whilst it is never known to continue above a day or two in the lower parts.

The common people of this island are of a tawny colour, and well shaped; though they have large feet, owing perhaps to the efforts they are obliged to make in climbing the craggy paths of this mountainous country. Their faces are oblong, their eyes dark; their black hair naturally falls in ringlets, and begins to crisp in some individuals, which may perhaps be owing to intermarriages with negroes; in general, they are hard-featured, but not disagreeable. Their women are too frequently ill-favoured, and want the florid complexion, which, when united to a pleasing assemblage of regular features, gives our northern fair ones the superiority over all their sex. They are small, have prominent cheek-bones, large feet, an ungraceful gait, and the colour of the darkest brunette. The just proportion of the body, the fine form of their hands, and their large, lively eyes, seem in some measure to compensate for those defects. The labouring men, in summer, wear linen trowsers, a coarse shirt, a large hat, and boots; some have a short jacket made of cloth, and a long cloak, which they sometimes carry over their arm. The women wear a petticoat, and a short corset or jacket, closely fitting their shapes, which is a simple, and often not an elegant dress. They have also a short, but wide cloak; and those that are unmarried tie their hair on the crown of their head, on which they wear no covering.

The country people are exceeding sober and frugal; their diet in general consisting of bread and onions, or other roots, and little animal-food. However, they avoid eating tripe, or any offals, because it is proverbially said of a very poor man, "He is reduced to eat tripe." Their common drink is water, or an infusion of the remaining rind or skin of the grape (after it has passed through the wine-press), which when fermented acquires some tartness and acidity, but

cannot be kept very long. The wine for which the island is so famous, and which their own hands prepare, seldom if ever regales them.

Their principal occupation is the planting and raising of vines; but as that branch of agriculture requires little attendance during the greatest part of the year, they naturally incline to idleness. The warmth of the climate, which renders great provision against the inclemencies of weather unnecessary, and the ease with which the cravings of appetite are satisfied, mult tend to indolence, wherever the regulations of the legislature do not counteract it, by endeavouring, with the prospect of increasing happiness, to infuse the spirit of industry. It seems the Portuguese government does not pursue the proper methods against this dangerous lethargy of the state. They have lately ordered the plantation of olive trees here, on such spots as are too dry and barren to bear vines; but they have not thought of giving temporary assistance to the labourers, and have offered no premium by which these might be induced to conquer their reluctance to innovations and aversion to labour.

The vineyards are held only on an annual tenure, and the farmer reaps but four-tenths of the produce, since four other tenths are paid in kind to the owner of the land, one tenth to the king, and one to the clergy. Such small profits, joined to the thought of toiling merely for the advantage of others, if improvements were attempted, entirely preclude the hopes of a future increase. Oppressed as they are, they have however preserved a high degree of cheerfulness and contentment; their labours are commonly alleviated with songs, and in the evening they assemble from different cottages to dance to the drowsy music of a guitar.

The inhabitants of the towns are more ill-favoured than the country-people, and often pale and lean. The men wear French clothes, commonly black, which do not seem to fit them, and have been in fashion in the polite world about half a century ago. Their ladies are delicate, and have agreeable features: but the characteristic jealousy of the men still locks them up, and deprives them of a happiness which the country-women, amidst all their distresses, enjoy. Many of the better people are a sort of *petite noblesse*, which we would call *gentry*, whose genealogical pride makes them unfriendly and ignorant, and causes a ridiculous affectation of gravity. The landed property is in the hands of a few ancient families, who live at Funchal, and in the various towns on the island.

Madeira consists of one large mountain, whose branches rise every-where from the sea towards the centre of the island, converging to the summit, in the midst of which is a depression or excavation, called the *Val* by the inhabitants, always covered with a fresh and delicate herbage. The stones on the island seem to have been in the fire, are full of holes, and of a blackish colour; in short, the greater part of them are lava. A few of them are of the kind which the Derbyshire miners call *dumstone*. The soil of the whole island is a tarras mixed with some particles of clay, lime, and sand, and has much the same appearance as some earths on the ile of Ascension. From this circumstance, and from the excavation of the summit of the mountain, it is probable, that in some remote period

Madeira's

Madeiras a volcano has produced the lava and the ochreous particles, and that the Val was formerly its crater.

Many brooks and small rivulets descend from the fummit in deep chafms or glens, which separate the various parts of the island. The beds of the brooks are in some places covered with stones of all sizes, carried down from the higher parts by the violence of winter-rains or floods of melted snow. The water is conducted by weirs and channels in the vineyards, where each proprietor has the use of it for a certain time; some being allowed to keep a constant supply of it, some to use it thrice, others twice, and others only once a-week. As the heat of the climate renders this supply of water to the vineyards absolutely necessary, it is not without great expence that a new vineyard can be planted; for the maintenance of which, the owners must purchase water at a high price, from those who are constantly supplied, and are thus enabled to spare some of it.

Wherever a level piece of ground can be contrived in the higher hills, the natives make plantations of eddoes enclosed by a kind of dike to cause a stagnation, as that plant succeeds best in swampy ground. Its leaves serve as food for hogs, and the country-people use the roots for their own nourishment.

The sweet potatoe is planted for the same purpose, and makes a principal article of diet; together with chestnuts, which grow in extensive woods, on the higher parts of the island, where the vine will not thrive. Wheat and barley are likewise sown, especially in spots where the vines are decaying through age, or where they are newly planted. But the crops do not produce above three months provisions; and the inhabitants are therefore obliged to have recourse to other food, besides importing considerable quantities of corn from North America in exchange for wine. The want of manure, and the inactivity of the people, are in some measure the causes of this disadvantage; but supposing husbandry to be carried to its perfection here, they could not raise corn sufficient for their consumption. They make their threshing-floors of a circular form, in a corner of a field, which is cleared and beaten solid for the purpose. The sheaves are laid round about it; and a square board, stuck full of sharp flints below, is dragged over them by a pair of oxen, the driver getting on it to increase its weight. This machine cuts the straw as if it had been chopped, and frees the grain from the husk, from which it is afterwards separated.

The great produce of Madeira is the wine, from which it has acquired fame and support. Where the soil, exposure, and supply of water, will admit of it, the vine is cultivated. One or more walks, about a yard or two wide, intersect each vineyard, and are included by stone-walls two feet high. Along these walks, which are arched over with laths about seven feet high, they erect wooden pillars at regular distances, to support a lattice-work of bamboos, which slopes down from both sides of the walk, till it is only a foot and a half or two feet high, in which elevation it extends over the whole vineyard. The vines are in this manner supported from the ground, and the people have room to root out the weeds which spring up between them. In the season of the vintage, they

creep under this lattice-work, cut off the grapes, and lay them into baskets: some bunches of these grapes weigh six pounds and upwards. This method of keeping the ground clean and moist, and ripening the grapes in the shade, contributes to give the Madeira wines that excellent flavour and body for which they are remarkable. The owners of vineyards are however obliged to allot a certain spot of ground for the growth of bamboos; for the lattice work cannot be made without them; and it is said some vineyards lie quite neglected for want of this useful reed.

The wines are not all of equal goodness, and consequently of different prices. The best, made of a vine imported from Candia by order of the Infante of Portugal, Don Henry, is called *Madeira Malmsley*, a pipe of which cannot be bought on the spot for less than 40 or 42 l. Sterling. It is an exceeding rich sweet wine, and is only made in a small quantity. The next sort is a dry wine, such as is exported for the London market, at 30 or 31 l. Sterling the pipe. Inferior sorts for the East India, West India, and North American markets, sell at 28, 25, and 20 l. Sterling. About 30,000 pipes, upon a mean, are made every year, each containing 110 gallons. About 13,000 pipes of the better sorts are exported; and all the rest is made into brandy for the Brazils, converted into vinegar, or consumed at home.

The inclosures of the vineyards consist of walls, and hedges of prickly pear, pomegranates, myrtles, brambles, and wild roses. The gardens produce peaches, apricots, quinces, apples, pears, walnuts, chestnuts, and many other European fruits; together with now and then some tropical plants, such as bananas, goavas, and pine-apples.

All the common domestic animals of Europe are likewise found at Madeira; and their mutton and beef, though small, is very well tasted. Their horses are small, but sure-footed; and with great agility climb the difficult paths, which are the only means of communication in the country. They have no wheel-carriages of any kind; but in the town they use a sort of drays or sledges, formed of two pieces of plank joined by cross pieces, which make an acute angle before; these are drawn by oxen, and are used to transport casks of wine, and other heavy goods, to and from the warehouses.

The animals of the feathered tribe, which live wild here, are more numerous than the wild quadrupeds; there being only the common grey rabbit here, as a representative of the last-mentioned class. Tame birds, such as turkeys, geese, ducks, and hens, are very rare, which is perhaps owing to the scarcity of corn.

There are no snakes whatsoever in Madeira; but all the houses, vineyards, and gardens, swarm with lizards. The friars of one of the convents complained to Mr Forster, that these vermin destroyed the fruit in their garden; they had therefore placed a brass-kettle in the ground to catch them, as they are constantly running about in quest of food. In this manner they daily caught hundreds, which could not get out on account of the smooth sides of the kettle, but were forced to perish.

The shores of Madeira, and of the neighbouring Salvages and Desertas, are not without fish; but as they are not in plenty enough for the rigid observance

Madian
||
Madrepora

of Lent, pickled herrings are brought from Gottenburg in English bottoms, and salted cod from New York and other American ports, to supply the deficiency.

MADIAN, (anc. geog.) a town of Arabia Petraea, near the Arnan; so called from one of the sons of Abraham by Ketura, in ruins in Jerome's time. Jerome mentions another **MADIAN**, or **MIDIAN**, beyond Arabia, in the desert, to the south of the Red Sea; and hence *Madianaei*, and *Madianitaei*, the people; and *Madianaea Regio*, the country.

MADNESS, a most dreadful kind of delirium, without fever. See (the *Index* subjoined to) **MEDICINE**.

MADDOX (Dr Isaac), an ingenious and worthy prelate, born of obscure parents about the year 1696, who placed him apprentice to a pastry-cook; but not relishing this employment, and having an inclination to learning, he was put to school by some friends, and completed his studies at Aberdeen. He entered into orders; and having the good fortune to be made chaplain to Dr Bradford bishop of Chichester, he married his niece, a very sensible and worthy lady. From this time his preferment may be dated; he was made king's chaplain, clerk of the closet to queen Caroline, and about the year 1736 bishop of St Asaph; from whence, in 1743, he was translated to Worcester. He was an excellent preacher, and a great promoter of public charities; particularly the Worcester infirmary, and the hospital for inoculating the small-pox at London: his sermon in favour of this latter institution, preached in 1752, was much admired, and contributed greatly to extend the practice of inoculation. He published some other single sermons, and a *Defence of the Doctrine and Discipline of the Church of England*, in answer to Mr Neale's *History of the Puritans*.—Dr Maddox died in 1759.

MADRAS. See *St George*.

MADRE DE POPA, a town and convent of South America, in Terra Firma, seated on the river Grande. It is almost as much resorted to by pilgrims of America as Loretto is in Europe; and the image of the Virgin Mary is said to have done many miracles in favour of the sea-faring people. W. Lon. 76. 6. N. Lat. 11. 0.

MADREPORA, in natural history, the name of a genus of submarine substances; the characters of which are, That they are almost of a stony hardness, resembling the corals, and are usually divided into branches, and pervious by many holes or cavities, which are frequently of a stellate figure.

In the Linnæan system, this is a genus of lithophyta: The animal that inhabits it is the Medusa; it comprehends 39 species. According to Donati, the madrepora is like the coral as to its hardness, which is equal to bone or marble; the colour is white when polished; its surface is lightly wrinkled, and the wrinkles run lengthwise of the branches; in the centre there is a sort of cylinder, which is often pierced thro' its whole length by two or three holes. From this cylinder are detached about 17 laminae, which run to the circumference in straight lines; and are transversely intersected by other laminae, forming many irregular cavities; the cellules, which are composed of these laminae ranged into a circle, are the habitations of little polypes, which are extremely tender animals, generally

transparent, and variegated with beautiful colours. Madrepores, M. de Peyssonel observes, that those writers who only considered the figures of submarine substances, denominated that class of them, which seemed pierced with holes, *pora*; and those the holes of which were large, they called *madrepora*. He defines them to be all those marine bodies which are of a stony substance, without either bark or crust, and which have but one apparent opening at each extremity, furnished with rays that proceed from the centre to the circumference. He observes that the body of the animal of the madrepora, whose flesh is so soft that it divides upon the gentlest touch, fills the centre; the head is placed in the middle, and surrounded by several feet or claws, which fill the intervals of the partitions observed in this substance, and are at pleasure brought to its head, and are furnished with yellow papillae. He discovered that its head or centre was lifted up occasionally above the surface, and often contracted and dilated itself like the pupil of the eye: he saw all its claws moved, as well as its head or centre. When the animals of the madrepora are destroyed, its extremities become white. In the madrepora, he says, the animal occupies the extremity; and the substance is of a stony but more loose texture than the coral. This is formed, like other substances of the same nature, of a liquor which the animal discharges; and he farther adds, that there are some species of the polype of the madrepora which are produced singly, and others in clusters.

MADRID, a town of New Castile in Spain, and capital of the whole kingdom, though it never had the title of a *city*, is situated in W. Long. 3. 5. N. Lat. 40. 26. It stands in the centre of a large plain, surrounded with mountains, and in the very heart of Spain, on the banks of the little river Manzanares, which is always very low and shallow, except when it is swelled by the melting of the snow on the mountains. The city is in general well laid out; the streets are very handsome; and the houses are fair and lofty, but built of brick, with lattice-windows, excepting those of the rich, who have glass in their windows; only, during the summer-heats, they use gauze, or some such thin stuff, instead of it, to let in the fresh air. There are two stately bridges here over the Manzanares, a great many magnificent churches, convents, hospitals, and palaces. The royal palace, which stands on the west side of the town, on an eminence, is spacious and magnificent, consisting of three courts, and commanding a fine prospect. At the east end of the town is the Prado, or pardo; which is a delightful plain, planted with regular rows of poplar trees, and watered with a great many fountains; where the nobility and gentry take the air on horseback, or in their coaches, and the common people on foot, or divert themselves with a variety of sports and exercises. Almost all the streets of Madrid are straight, wide, clean, and well paved. The largest and most frequented are the street of Alcalá, that of Atocha, that of Toledo, and the *Calle grande* or great street. Madrid has also several squares, which in general are not very regular. The principal are those of San Joachim, Sol, Lasganas, San Domingo, La Cevada, and the Plaza Mayor. The latter especially deserves notice for its spaciousness and regularity, and the elegant and lofty houses it contains. It is fifteen hundred and thirty-six feet in circuit.

Madrepores,
Madrid.

Madrid. cut. The houses, of which there are 136, are of five stories, ornamented with balconies; the first of which, supported by pillars, form a piazza round the square, where the inhabitants may walk under cover. In the middle of the square a market is kept.—The streets and squares of Madrid, except the Plaza Mayor which has been just described, are ornamented with fountains in a very ill taste. Those most to be distinguished in this particular are the fountain of the small irregular square called *Plaza de Antonio Martin*, and that of the square named *Puerta del Sol*. The others are not more magnificent though less ridiculous. The water of all these fountains is excellent; and the air of Madrid, though the weather be variable and uncertain, is extremely pure. It was this purity of the air and excellent quality of the water which induced Philip II. and his successors to fix their residence in this city. It is also well supplied with provisions of all kinds at reasonable rates; and the court, with the resort and residence of the quality, and the high colleges and offices that are kept here, occasion a brisk trade and circulation of money.

The facade edifices in this city have nothing remarkable in their architecture: those of St Paul, St Isabella, and the Carmelites, contain highly valuable collections of pictures which may be seen with admiration even after the paintings of the Escorial and the new palace. The church of St Ildro, which heretofore belonged to the Jesuits, has a portal which has escaped the contagion of the age in which it was built. There is another church much more modern, which on account of its masonry has a venerable appearance, but which true taste may justly disavow: it is that of St Salefas, or the visitation, founded by Ferdinand VI. and the queen Barbara his wife.—The convent of St Francis has already been some years building *, and there are hopes that it will become one of the finest productions of architecture in the capital.—Besides a variety of charitable foundations, there are here three confraternities, the revenues of which are appropriated to the succour of the wretched; and an institution similar to the *Mont de Piété* in Paris, the principal object of which is to advance money to the necessitous.

[illegible]

There are four academies in Madrid: The first is the Spanish academy founded in 1714, in imitation of the French academy, and consisting of 24 members, including the president. Its device is a crucible on

burning coals with the motto *Impia, fixa, et da splendore*; "it purifies, fixes, and gives lustre." Its first object was the compilation of a dictionary of the Spanish language, which was published in six volumes folio and of which a new edition, with great additions, has been lately put to the press. The same academy has also employed on a superb edition of *Don Quixotte*, adorned with elegant engravings far superior to the last, and collated with all the former editions. The second is the academy of history; which owes its origin to a society of individuals, the object of whose meetings was to preserve and illustrate the historical monuments of the kingdom of Spain. Their labours met the approbation of Philip V. who in 1738 confirmed their statutes by a royal cedula. This academy consists of 24 members, including the president, secretary, and censor. Its device is a river at its source; and the motto, *In patriam populumque fluit*. The other two academies are the academy of the fine arts, painting, sculpture, and architecture; and the academy of medicine. The latter is held in no great esteem.

The environs of Madrid contain several royal seats; among which are El Buen Retiro, Cafal del Campo, Florida, Le Pardo, Sarfuela, and St Ildefonso; but the most magnificent not only in this country but perhaps in the whole world is the Escorial, which takes its name from a small village, near which it stands, about 22 miles north-west from Madrid; and of which a description is given under the article *ESCURIAL*. Another royal palace, greatly admired particularly for its delicious gardens and surpassing water-works, is Aranjuez, which is situated on the Tagus, about 30 miles south of Madrid. See *ARANJUEZ*.

MADRIGAL, a short amorous poem, composed of a number of free and unequal verses, neither confined to the regularity of a sonnet, nor to the point of an epigram; but only consisting of some tender and delicate thought, expressed with a beautiful, noble, and elegant simplicity.

Menage derives the word from *mandra*, which, in Latin and Greek, signifies "a sheep-fold," imagining it to have been originally a kind of pastoral or shepherd's song; whence the Italians formed their *madrigale*, and we *madrigal*. Others rather chooſe to derive it from the word *madrugar*, which in the Spaniſh language ſignifies "to riſe in the morning;" the *madrigales* being formerly ſung early in the morning by thoſe who had a mind to ſerenade their miſtreſſes.

MADURAI, a province of Asia, in the peninsula on this side the Ganges; bounded on the east by Tanjour and Marava, on the south-east by the sea, on the west by the Balagate mountains, which separate it from Malabar, and on the north by Vissapour and Carnate. The inhabitants are Gentoos, and of a thievish disposition. The commodities are rice, elephants teeth, and cotton-cloth; of which last a great deal is made here, and very fine. The Dutch have a pearl-fishery, which brings them in a large sum annually.

MÆANDER (anc. geog.), a celebrated river of Asia Minor, rising near Celænzæ. It flows through Caria and Ionia into the *Ægean* sea between Miletus and Priene, after it has been increased by the waters of the *Marfyas*, *Lycus*, *Eudon*, *Lethæus*, &c. It is cele-

Madrid
b)
Mæander.

• Bourgo-
anne's Tre-
vols in Spain,
1789.

Mæcenas
Mæccenas

celebrated among the poets for its windings, which amount to not less than 600, and from which all obliquities have received the name of *mæanders*. It forms in its course, according to the observation of some travellers, the Greek letters ϵ & ω ; and from its windings Dædalus is said to have had the first idea of his famous labyrinth.

MÆATÆ, anciently a people of Britain, near *Severus's* wall, inhabiting the district now called *Lauderdale*, in Scotland.

MÆCENAS (Caius Cilnius), the great friend and counsellor of Augustus Cæsar, was himself a very polite scholar, but is chiefly memorable for having been the patron and protector of men of letters. He was descended from a most ancient and illustrious origin, even from the kings of Etruria, as Horace often tells us; but his immediate forefathers were only of the equestrian order. He is supposed to have been born at Rome, because his family lived there; but in what year, antiquity does not tell us. It says as little about his education; but we know it must have been of the most liberal kind, and perfectly agreeable to the dignity and splendor of his birth, since he excelled in every thing that related to arms, politics, and letters. How Mæcenas spent his younger years is also unknown to us, any farther than by effects; there being no mention made of him by any writer before the death of Julius Cæsar, which happened in the year of Rome 709. Then Octavius Cæsar, who was afterwards called Augustus, went to Rome, to take possession of his uncle's inheritance; and then Mæcenas became first publicly known, though he appears to have been Augustus's intimate friend, and as it should seem guardian, from his childhood. From that time he accompanied him through all his fortunes, and was his counsellor and adviser upon all occasions; so that *Pedo Albino-vanus* justly called him *Cæsar's dextram*, "Cæsar's right-hand."

In A. R. 710, the year that Cicero was killed and Ovid born, Mæcenas distinguished himself by his courage and military skill at the battle of Modena, where the consuls Hirtius and Panfa were slain in fighting against Antony; as he did afterwards at Philippi. After this last battle began the memorable friendship between Mæcenas and Horace. Horace, as Suetonius relates, was a tribune in the army of Brutus and Cassius, and upon the defeat of those generals made a prisoner of war. Mæcenas, finding him an accomplished man, became immediately his friend and protector; and afterwards recommended him to Augustus, who restored to him his estate with no small additions. In the mean time, though Mæcenas behaved himself well as a soldier in these and other battles, yet his principal province was that of a minister and counsellor. He was the adviser, the manager, the negotiator, in every thing that related to civil affairs. When the league was made at Brundisium between Antony and Augustus, Mæcenas was sent to act on the part of Augustus. This we learn from Horace in his journey to Brundisium:

*Huc venturus erat Mæcenas optimus, atque
Cœcilius, missi magnis de rebus uterque*

Legati, avertis soliti componere amicos. Sat. v. l. 1.

And afterwards, when this league was near breaking,

through the suspicions of each party, Mæcenas was sent to Antony to ratify it anew.

In the year 717, when Augustus and Agrippa went to Sicily to fight Sextus Pompeius by sea, Mæcenas went with them; but soon after returned, to appease some commotions which were rising at Rome; for though he usually attended Augustus in all his military expeditions, yet, whenever there was any thing to be done at Rome either with the senate or people, he was always dispatched thither for that purpose.

Upon the total defeat of Antony at Actium, Mæcenas returned to Rome, to take the government into his hands, till Augustus could settle some necessary affairs in Greece and Asia. Agrippa soon followed Mæcenas; and when Augustus arrived, he placed these two great men and faithful adherents, the one over his civil the other over his military concerns. While Augustus was extinguishing the remains of the civil war in Asia and Egypt, young Lepidus, the son of the triumvir, was forming a scheme to assassinate him at his return to Rome. This conspiracy was discovered at once, by the extraordinary vigilance of Mæcenas; who, as Velleius Paterculus says, "observing the rash councils of the headstrong youth with the same tranquillity and calmness as if nothing at all had been doing, instantly put him to death, without the least noise and tumult; and by that means extinguished another civil war in its very beginning."

The civil wars being now at an end, Augustus returned to Rome; and from this time Mæcenas indulged himself at vacant hours in literary amusements, and the conversation of men of letters. In the year 734 Virgil died, and left Augustus and Mæcenas heirs to what he had. Mæcenas was exceedingly fond of this poet, who, of all the wits of the Augustan age, stood highest in his esteem; and if the *Georgics* and the *Æneid* be owing to the good taste and encouragement of this patron, as there is some reason to think, posterity cannot commemorate him with too much gratitude. Horace may be ranked next to Virgil in Mæcenas's good graces: we have already mentioned how and at what time their friendship commenced. Propertius also acknowledges Mæcenas for his favourite and protector, lib. ii. eleg. 7. Nor must Varius be forgot, though we have nothing of his remaining; since we find him highly praised by both Virgil and Horace. He was a writer of tragedies; and Quintilian thinks he may be compared with any of the ancients. In a word, Mæcenas's house was a place of refuge and welcome to all the learned of his time; not only to Virgil, Horace, Propertius, and Varius, but to Fundanius, whom Horace extols as an admirable writer of comedies; to Fulcus Ariftius, a noble grammarian, and Horace's intimate friend; to Plotius Tucea, who assisted Varius in correcting the *Æneid* after the death of Virgil; to Valgius, a poet and very learned man, who, as Pliny tells us, dedicated a book to Augustus, *De usu Herbarum*; to Asinius Pollio, an excellent tragic writer; and to several others, whom it would be tedious to mention. All these dedicated their works, or some part of them at least, to Mæcenas, and celebrated his praises in them over and over; and we may observe farther, what Plutarch tells us, that even Augustus himself inscribed his Commentaries to him and to Agrippa.

Mæcenas

Mæcenas,
Mæcstrom.

Mæcstrom.

Mæcenas continued in Augustus's favour to the end of his life, but not uninterruptedly. Augustus had an intrigue with Mæcenas's wife: and though the minister bore this liberty of his master very patiently, yet there was a coldness on the part of Augustus, which, however, soon went off. Mæcenas died in the year 745; but at what age we cannot precisely determine, though we know he must have been old. He must have been older than Augustus, because he was a kind of tutor to him in his youth: and then find him often called an *old man* by Pædo Albinovanus, a contemporary poet, whose elegy upon his dead patron is still extant. He made Augustus his heir; and recommended his friend Horace to him in those memorable last words, "*Horati! Flacci, ut mori, memor esto, &c.*" Horace, however, did not probably survive him long, as there is no elegy of his upon Mæcenas extant, nor any account of one having ever been written, which there certainly would have been had Horace survived him any time. Nay, Father Sanadon, the French editor of Horace, will have it, that the poet died before his patron; and that these last words were found only in Mæcenas's will, which had not been altered.

Mæcenas is said never to have enjoyed a good state of health in any part of his life: and many singularities are related of his bodily constitution. Thus Pliny tells us, that he was always in a fever; and that, for three years before his death, he had not a moment's sleep. Though he was certainly an extraordinary man, and possessed many admirable virtues and qualities, yet it is agreed on all hands, that he was very luxurious and effeminate. "Mæcenas (says Velleius Paterculus) was of the equestrian order, but sprung from a most illustrious origin. He was a man, who, when business required, was able to undergo any fatigue and watching; who consulted properly upon all occasions, and knew as well how to execute what he had consulted; yet a man who in seasons of leisure was luxurious, soft, and effeminate, almost beyond a woman. He was no less dear to Cæsar than Agrippa, but distinguished by him with fewer honours; for he always continued of the equestrian rank, in which he was born: not that he could not have been advanced upon the least intimation, but he never solicited it."

But let moralists and politicians determine of Mæcenas as they please, the men of letters are under high obligations to celebrate his praises and revere his memory: for he countenanced, protected, and supported, as far as they wanted his support, all the wits and learned men of his time; and that too, out of a pure and disinterested love of letters, when he had no little views of policy to serve by their means: whence it is no wonder, that all the protectors and patrons of learning, ever since, have usually been called *Mæcenas's*.

MAELSTROM, a very dangerous whirlpool on the coast of Norway, in the 68th degree of latitude, in the province of Nordland, and the district of Lofoden, and near the island of Moskoe, from whence it also takes the name of *Moskoe-ström*. Its violence and roarings exceed that of a cataract, being heard to a great distance, and without any intermission, except a quarter every sixth hour, that is, at the turn of high and low water, when its impetuosity seems at a stand, which short interval is the only time the fishermen can venture in: but this motion soon returns, and, however calm the sea may be, gradually increases with such a

draught and vortex as absorb whatever comes within their sphere of action, and keep it under water for some hours, when the fragments, shivered by the rocks, appear again. This circumstance, among others, makes strongly against Kircher and others, who imagine that there is here an abyss penetrating the globe, and issuing in some very remote parts, which Kircher is so particular as to assign, for he names the gulph of Bothnia. But after the most exact researches which the circumstances will admit, this is but a conjecture without foundation; for this and three other vortices among the Ferroe islands, but smaller, have no other cause, than the collision of waves rising and falling, at the flux and reflux, against a ridge of rocks and shelves, which confine the water so that it precipitates itself like a cataract; and thus the higher the flood rises, the deeper must the fall be; and the natural result of this is a whirlpool or vortex, the prodigious suction whereof is sufficiently known by lesser experiments. But what has been thus absorbed, remains no longer at the bottom than the ebb lasts; for the suction then ceases, and the flood removes all attraction, and permits whatever had been sunk to make its appearance again. Of the situation of this amazing Moskœstrom we have the following account from Mr Jonas Ramus, "The mountain of Helsinggen, in Lofoden, lies a league from the island Ver, and betwixt these two runs that large and dreadful stream called *Moskœstrom*, from the island Moskœ, which is in the middle of it, together with several circumjacent isles, as Ambaaren, half a quarter of a league northward, Isefen, Hoeholm, Kieldholm, Suarven, and Buckholm. Moskœ lies about half a quarter of a mile south of the island of Ver, and betwixt them these small islands, Otterholm, Flimen, Sandfelsen, Stockholm. Betwixt Lofoden and Moskœ, the depth of the water is between 36 and 40 fathoms; but on the other side, towards Ver, the depth decreases so as not to afford a convenient passage for a vessel, without the risk of splitting on the rocks, which happens even in the calmest weather: when it is flood, the stream runs up the country between Lofoden and Moskœ with a boisterous rapidity; but the roar of its impetuous ebb to the sea is scarce equalled by the loudest and most dreadful cataracts; the noise being heard several leagues off, and the vortices or pits are of such an extent and depth, that if a ship comes within its attraction, it is inevitably absorbed and carried down to the bottom, and there beat to pieces against the rocks; and when the water relaxes, the fragments thereof are thrown up again. But these intervals of tranquillity are only at the turn of the ebb and flood, and calm weather: and last but a quarter of an hour, its violence gradually returning. When the stream is most boisterous, and its fury heightened by a storm, it is dangerous to come within a Norway mile of it; boats, ships, and yachts having been carried away, by not guarding against it before they were within its reach. It likewise happens frequently, that whales come too near the stream, and are overpowered by its violence; and then it is impossible to describe their howlings and bellowsings in their fruitless struggles to disengage themselves. A bear once attempting to swim from Lofoden to Moskœ, with a design of preying upon the sheep at pasture in the island, afforded the like spectacle to the people; the stream caught him, and bore him down, whilst he

Mæmactæ-roared terribly, so as to be heard on shore. Large flocks of firs and pine trees, after being absorbed by the current, rise again, broken and torn to such a degree as if bristles grew on them. This plainly shows the bottom to consist of craggy rocks, among which they are whirled to and fro. This stream is regulated by the flux and reflux of the sea; it being constantly high and low water every six hours. In the year 1645, early in the morning of Sexagesima Sunday, it raged with such noise and impetuosity, that on the island of Moskoe, the very stones of the houses fell to the ground."

MÆMACTERIA, sacrifices offered to Jupiter at Athens in the winter month Mæmactærian. The god furnished Mæmactæ with intreat to send mild and temperate weather, as he presided over the seasons, and was the god of the air.

MÆMACTERION was the fourth month of the Athenian year, containing twenty-nine days, and answering to the latter part of our September, and the beginning of October. It received its name from the festival *Mæmactæria*, which was observed about this time. This month was called by the Boeotians *Alalcomenius*.

MÆNA, in ichthyology. See **SPARUS**.

MÆNALUS (anc. geog.) a mountain of Arcadia sacred to the god Pan, and greatly frequented by shepherds. It received its name from Mænalus a son of Lycaon. It was covered with pine trees, whose echo and shade have been greatly celebrated by all the ancient poets.

MÆONIA, or **MOEONIA**, a country of Asia Minor, and forming part of Lydia; namely the neighbourhood of mount Tmolus, and the country watered by the Pactolus. The rest on the sea-coast was called Lydia. See **LYDIA**.

MÆONIDÆ, a name given to the Muses, because Homer, their greatest and worthiest favourite, was supposed to be a native of Mæonia.

MÆONIDES, a surname of Homer, because, according to the opinion of some writers, he was born in Mæonia, or because his father's name was Mæon.

MÆOTIS PALUS or **LACUS**, *Mæotica Palus*, or *Mæoticus Lacus*, (anc. geog.), a large lake or part of the sea between Europe and Asia, at the north of the Euxine, to which it communicates by the Cimerian Bosphorus. It was worshipped as a deity by the Massagetæ. It extends about 390 miles from south-west to north-east, and is about 600 miles in circumference. Still called *Palus Mæotis*, reaching from Crim Tartary to the mouth of the Don.

MÆSTLIN (Michael), in Latin *Mæstlinus*, a celebrated astronomer of Germany, was born in the duchy of Wittenberg; but spent his youth in Italy, where he made a speech in favour of Copernicus's system, which brought Galilæo over from Aristotle and Ptolemy, to whom he had been hitherto entirely devoted. He afterwards returned to Germany, and became professor of mathematics at Tübingen; where, among his other scholars, he taught the great Kepler, who has praised several of his ingenious inventions, in his *Astronomia Optica*. Though Tycho Brahe did not assent to Mæstlin's opinion, yet he allowed him to be an extraordinary person deeply skilled in the science of astronomy. Mæstlin published many mathematical and astronomical works; and died in 1590.

MÆSTRICHT, an ancient large, and strong town of the Netherlands, ceded to the Dutch by the treaty of Munster. The town-house and the other public buildings are handsome, and the place is about four miles in circumference, and strongly fortified. It is governed jointly by the Dutch and the bishop of Liege; however, it has a Dutch garrison. The inhabitants are noted for making excellent fire-arms, and some say that in the arsenal there are arms sufficient for a whole army. Both Papists and Protestants are allowed the free exercise of their religion, and the magistrates are composed of both. It is seated on the river Maese, which separates it from Wyck, and with which it communicates by a handsome bridge. Mæstricht revolted from the Spaniards in 1570, but was reduced in 1579. Louis XIV. became master of it in 1673; but it was restored to the states by the treaty of Nimeguen in 1678. E. Long. 5. 50. N. Lat. 51. 5.

MAFFÆUS (Vegio), a Latin poet, born in Lombardy in 1407, was greatly admired in his time. He wrote epigrams, and a humorous supplement to Virgil, which he called *The thirteenth book of the Æneid*: this was as humorously translated into English a few years since by Mr Ellis. Maffæus wrote also some prose works. He was chancellor of Rome towards the end of the pontificate of Martin V.; and died in 1458.

MAFFEI (Scipio), a celebrated Italian poet, born of an illustrious and ancient family at Verona, in 1675. After having finished his studies, he took arms, and distinguished himself by his valour at the battle of Donawert; but he more particularly distinguished himself by his love of learning, which made him undertake several voyages into France, England, and Germany. He conversed with the learned in all those countries, and obtained their friendship and esteem. He was a member of the academy of the Arcadia at Rome, an honorary foreign member of that of Inscriptions at Paris; and died in 1755. He wrote many works in verse and prose, which are esteemed; the most known of which are, 1. The tragedy of Merope, of which there are two French translations in prose. 2. Ceremony, a comedy. 3. A translation, into Italian verse, of the first book of Homer's Iliad. 4. Many other pieces of poetry, in a collection intitled *Rhyme and Prose*, quarto. His principal works in prose, are, 1. *Verona illustrata*. 2. *Istoria diplomatica*. 3. *Scienza cavalleresca*; an excellent work, in which he attacks duelling. 4. An edition of *Theatro Italiano*. 5. An edition of Cassiodorus on the Epistles, Acts of the Apostles, and Apocalypse. 6. *Gallie antiquitates quedam selectæ aque in plures epistolas distributæ*; and several other works.

MAGADA, in mythology, a title under which Venus was known and worshipped in Lower Saxony; where this goddess had a famous temple, which was treated with respect even by the Huns and Vandals when they ravaged the country. It is said to have been destroyed by Charlemagne.

MAGADOXO, the capital town of a kingdom of the same name, in Africa, and on the coast of Ajan. It is seated near the mouth of a river of the same name, defended by a citadel, and has a good harbour. The inhabitants are Mahometans. E. Long. 45. 15. N. Lat. 3. 0.

MAGAS. **MAGADIS**, (from μαγάδιον "to sing or play in unison or octave," the name of a musical instrument in use among the ancients.

There were two kinds of *magades*, the one a string instrument, formed of 20 chords arranged in pairs, and tuned to unison or octave, so that they yielded ten sounds; the invention whereof is ascribed by some to Sappho; by others, to the Lydians; and by some, to Timotheus of Miletus. The other was a kind of flute, which at the same time yielded very high and very low notes. The former kind was at least much improved by Timotheus of Miletus, who is said to have been impeached of a crime, because by increasing the number of chords he spoiled and discredited the ancient music.

MAGAZINE, a place in which stores are kept, of arms, ammunition, provisions, &c. Every fortified town ought to be furnished with a large magazine, which should contain stores of all kinds, sufficient to enable the garrison and inhabitants to hold out a long siege; and in which smiths, carpenters, wheel-wrights, &c. may be employed in making every thing belonging to the artillery; as carriages, waggon, &c.

Powder MAGAZINE, is that place where the powder is kept in very large quantities. Authors differ greatly both with regard to the situation and construction; but all agree, that they ought to be arched and bomb-proof. In fortifications, they are frequently placed in the rampart; but of late they have been built in different parts of the town. The first powder-magazines were made with Gothic arches: but M. Vauban finding them too weak, constructed them in a semicircular form; whose dimensions are 60 feet long within, 25 broad; the foundations are eight or nine feet thick, and eight feet high from the foundation to the spring of the arch; the floor is two feet from the ground, which keeps it from dampness.

One of our engineers of great experience some time since had observed, that after the centres of semicircular arches are struck, they settle at the crown and rise up at the hanches, even with a straight horizontal extrados, and still much more so in powder-magazines, whose outside at top is formed like the roof of a house, by two inclined planes joining in an angle over the top of the arch, to give a proper descent to the rain; which effects are exactly what might be expected agreeable to the true theory of arches. Now, as this shrinking of the arches must be attended with very ill consequences, by breaking the texture of the cement after it has been in some degree dried, and also by opening the joints of the voussiors at one end, so a remedy is provided for this inconvenience with regard to bridges, by the *arch of equilibration* in Mr Hutton's book on bridges; but as the ill effect is much greater in powder-magazines, the same ingenious gentleman proposed to find an arch of equilibration for them also, and to construct it when the span is 20 feet, the pitch or height 10 (which are the same dimensions as the semicircle), the inclined exterior walls at top forming an angle of 113 degrees, and the height of their angular point above the top of the arch equal to seven feet. This very curious question was answered in 1775 by the reverend Mr Wildbore, to be found in Mr Hutton's *Miscellaneous Mathematica*.

VOL. X. Part II.

Artillery MAGAZINE. In a siege, the magazine is made about 25 or 30 yards behind the battery, towards the parallels, and at least three feet underground, to hold the powder, loaded shells, port fires, &c. Its sides and roof must be well secured with boards to prevent the earth from falling in: a door is made to it, and a double trench or passage is sunk from the magazine to the battery, one to go in and the other to come out at, to prevent confusion. Sometimes traverses are made in the passages to prevent ricochet shot from plunging into them.

MAGAZINE, on ship-board, a close room or store-house, built in the fore or after part of the hold, to contain the gunpowder used in battle. This apartment is strongly secured against fire, and no person is allowed to enter it with a lamp or candle: it is therefore lighted, as occasion requires, by means of the candles or lamps in the *light-room* contiguous to it.

MAGAZINE Air-Gun. See *Air-Gun*.

MAGAZINES (Literary); a well known species of periodical publications, of which the first that appeared was *The Gentleman's*, set on foot by the inventor Mr Edward Cave in the year 1731: (see the article *CAVE*). This, as Dr Kippis observes, "may be considered as something of an epocha in the literary history of this country. The periodical performances before that time were almost wholly confined to political transactions, and to foreign and domestic occurrences; but the monthly magazines have opened a way for every kind of inquiry and information. The intelligence and discussion contained in them are very extensive and various; and they have been the means of diffusing a general habit of reading through the nation, which in a certain degree hath enlarged the public understanding. Many young authors, who have afterwards risen to considerable eminence in the literary world, have here made their first attempts in composition. Here too are preserved a multitude of curious and useful hints, observations, and facts, which otherwise might have never appeared; or if they had appeared in a more evanescent form, would have incurred the danger of being lost. If it were not an invidious task, the history of them would be no incurious or unentertaining subject. The magazines that unite utility with entertainment, are undoubtedly preferable to those (*if there have been any such*) which have only a view to idle and frivolous amusement. It may be observed, that two of them, *The Gentleman's* and *The London*, which last was begun the year after the former, have amidst their numerous rivals preserved their reputation to the present day. They have both of them, in general, joined instruction with pleasure; and this likewise hath been the case with some others of a later origin."—The original London Magazine, it is believed, has been discontinued for some years past.—The next oldest publication of this kind is that intitled *The Scots Magazine*; which was commenced at Edinburgh a few years posterior to the appearance of the *Gentleman's* at London; which, like it, has survived many rivals; and which still subsists, deservedly esteemed for the chasteness of its plan and the accuracy of its information.

MAGDALEN (Mary). See *MARY*.

Religious of St MAGDALEN, a denomination given to divers communities of nuns, consisting generally of pen-

Magazine, **Magda-len**.

Magdalen
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Magde-
burg.

nitent courtézans; sometimes also called *Magdalenettes*. Such are those at Metz, established in 1452; those at Paris, in 1492; those at Naples, first established in 1324, and endowed by Queen Sancha, to serve as a retreat for public courtézans, who should betake themselves to repentance; and those of Rouen and Bourdeaux, which had their original among those of Paris in 1618. In each of these monasteries there are three kinds of persons and congregations; the first consist of those who are admitted to make vows, and these bear the name of *St Magdalen*; the congregation of *St Martha* is the second, and is composed of those whom it is not judged proper to admit to vows; finally, the congregation of *St Lazarus* is composed of such as are detained there by force.

The religious of *St Magdalen* at Rome were established by Pope Leo X. Clement VIII. settled a revenue on them; and farther appointed, that the effects of all public prostitutes, dying intestate, should fall to them; and that the testaments of the rest should be invalid unless they bequeathed a portion of their effects, which was to be at least a fifth part, to them.

MAGDALEN-Hospital. See LONDON, n° 115.

MAGDALENA, one of the Marquesas islands, about five leagues in circuit, and supposed to be in S. Lat. 10. 25. W. Long. 138. 50. It was only seen at nine leagues distance by those who discovered it.

MAGDALENE'S CAVE, a cave of Germany, and in Carinthia, 10 miles east of Goetz. It appears like a chafin in a rock, and at the entrance torches are lighted to conduct travellers. It is divided into several apartments, or halls, with a vast number of pillars formed by nature, which give it a beautiful appearance; they being as white as snow, and almost transparent. The bottom is of the same substance, in so much that a person may fancy himself to be walking among the ruins of an enchanted castle, surrounded with magnificent pillars, some entire and others broken.

MAGDEBURG, a duchy of Germany, in the circle of Lower Saxony; bounded on the north by the duchy of Mecklenburgh, on the south and south-west by the principality of Anhalt and Halberstadt, on the east by Upper Saxony with part of Brandenburg, and on the west by the duchy of Wolfenbuttle. The Saale circle, and that of Luchtenwalde, are separated from the rest, and surrounded on all sides by a part of Upper Saxony. This country is, for the most part, level; but sandy, marshy, or overgrown with woods. There are salt springs in it so rich, that they are sufficient to supply all Germany with that commodity. The Holz circle is the most fruitful part of it. In the Saale circle, where wood is scarce, there is pit-coal; and at Rothenburg is a copper-mine worked. The duchy is well watered, for the Elbe passes through it; and the Saale, Havel, Aller, Ohre, and Elster, either rise in, or wash some part of it in their course. The whole duchy, exclusive of that part of the county of Mansfeldt which is connected with it, is said to contain 29 cities, six towns, about 430 villages, and 330,000 inhabitants. The states of the country consist of the clergy, the nobility, and deputies of the cities. Before it became subject to the electoral house of Brandenburg, frequent diets

were held in it; but at present no diets are held, nor have the states the direction of the finances as formerly. Before the Reformation, it was an archbishopric, subject in spirituals to the pope alone, and its prelate was primate of all Germany; but embracing the Reformation, it chose itself administrators, till the treaty of Munster in 1648, when it was given, together with the bishopric of Halberstadt, to the elector of Brandenburg, as an equivalent for the Hither Pomerania, granted by that treaty to the king of Sweden. Lutheranism is the predominant religion here; but Calvinists, Jews, and Roman-catholics, are tolerated. Of the last there are five convents, who never embraced the Reformation. All the Lutheran parishes, amounting to 314, are subject to 16 inspectors, under one general superintendent; only the clergy of the old town of Magdeburg are under the direction of their senior. The Jews have a synagogue at Halle. The manufactures of the duchy are cloth, stuff, stockings, linen, oil-skins, leather, and parchment; of which, and grain of all sorts, large quantities are exported. The arms of it are, Party per pale, ruby, and pearl. The king of Prussia, as duke of Magdeburg, sits and votes between the elector of Bavaria, as duke of Bavaria, and the elector palatine, as palgrave of Lautern. Of the states of the circle of Lower Saxony he is the first. His matricular assessment for the duchy is 43 horse and 196 foot, or 1300 florins monthly; and to the chamber of Witzlar 343 florins and 40 kruitzers. For the civil government of the duchy there is a council of regency, with a war and demesne chamber; and for the ecclesiastical, a consistory, and general superintendent. The revenues of the duchy, arising from the salt-works, demesnes, and taxes, some of which are very heavy and oppressive, are said to amount to 800,000 rixdollars annually. With respect to salt, every housekeeper in the Prussian dominions is obliged to buy a certain quantity for himself and wife; and also for every child and servant, horse, cow, calf, and sheep, that he possesses. The principal places are Magdeburg, Halle, and Glauche.

MAGDEBURG, a city of Germany, in a duchy of the same name, of which it is not only the capital, but that of all Lower Saxony, and formerly even of all Germany. It stands on the Elbe, in E. Long. 12. 9. N. Lat. 52. 16. It is a city of great trade, strongly fortified, and very ancient. Its name signifies the *maiden city*; which, some imagine, took its rise from the temple of Venus, which is said to have stood here anciently, and to have been destroyed by Charlemagne. The founder of the city is supposed to have been Otho I. or his empress Editha, daughter to Edmund the Saxon king of England. The same emperor founded a Benedictine convent here, which he afterwards converted into an archbishopric, of which the archbishop was a count-palatine, and had very great privileges, particularly that of wearing the archiepiscopal pallium, and having the cross borne before him, besides many others. The first tournament in Germany is said to have been appointed near this city, by the emperor Henry the Fowler; but these pastimes were afterwards abolished, because they occasioned such envy and animosity among the nobility, that several of them killed one another upon the spot.

Magde-
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Magdolm

Magellae
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Maggl.

spot. The situation of the city is very convenient and pleasant, upon the banks of the Elbe, amidst spacious fruitful plains, and on the road betwixt High and Low Germany. It has been a great sufferer by fires and sieges; but by none so much as that in 1631, when the emperor's general, count Tilly, took it by storm, plundered and set it on fire, by which it was entirely reduced to ashes, except the cathedral, the convent of our Lady, and a few cottages belonging to fishermen; of 40,000 burghers, not above 400 escaping. The soldiers spared neither age nor sex; but ripped up women with child, murdered sucking infants in sight of their parents, and ravished young women in the streets; to prevent which violation, many of them flung themselves into the Elbe, and others into the fire. The city is now populous, large, and well built, particularly the broad street and cathedral-square. The principal buildings are the king's palace, the governor's house, the armoury, guild-hall, and cathedral. The last is a superb structure in the antique taste, dedicated to St Maurice, which has a fine organ, the master-pipe of which is so big, that a man can scarce clasp it with both arms; it also contains the tombs of the emperor Otho and the empress Editha; a fine marble statue of St Maurice, a porphyry fent, an altar in the choir of one stone of divers colours, curiously wrought, and many other curiosities. They show here a bedstead and table which belonged to Martin Luther, when he was an Augustine friar in a cloyster of this city before the Reformation. Among the reliëts, they pretend to have the basin in which Pilate washed his hands after his condemnation of our Saviour; the lantern which Judas made use of when he apprehended him; and the ladder on which the cock crowed after St Peter denied him. The chapter consists of a provost, 16 major and seven minor canons; besides which, there are four other Lutheran collegiate foundations, and a Lutheran convent dedicated to our Lady, in which is a school or seminary. Here is also a gymnasium, with an academy, in which young gentlemen are instructed in the art of war. The canons of the chapter, which, except the change of religion, is upon the same footing as before the Reformation, must make proof of their nobility. The prebends and dignities are all in the gift of the elector; and the revenue of the provost is computed at 12,000 crowns a-year. Here is a great trade, and a variety of manufactures. The chief are those of woollen cloths and stuffs, silks, cottons, linen, stockings, hats, gloves, tobacco and snuff. The city was formerly one of the Hanse and Imperial towns. Editha, consort to Otho I. on whom it was conferred as a dowry, among many other privileges and advantages, procured it the grant of a yearly fair. The bargavate of this city was anciently an office of great power; having the civil and criminal jurisdiction, the office of hereditary cup-bearer being annexed to it; and was long held as a fief of the archbishopric, but afterwards became an imperial fief, which was again conferred on the archbishopric by the elector of Saxony, upon certain conditions.

MAGDOLM, or MAGDALUM (anc. geog.), a town of the Lower Egypt, twelve miles to the south of Pelusium (Herodotus, Antonine), which doubtless is the Migdol or Magdol of Jeremiah.—Another

MAGDALUM, or MIGDOL, denoting literally "a tower or place of strength," near the Red Sea, (Moses); far to the south of the former.

MAGELLAN (Ferdinand), a celebrated Portuguese mariner in the 16th century. He being dissatisfied with the king of Portugal, went into the service of the emperor Charles V. and sailed from Seville with five vessels in 1519, when he discovered and passed the strait to which he gave his own name, and sailed through the South Sea to the Ladrone Islands, when, according to some authors, he was poisoned in 1520; though others say that he was killed in a mutiny of his people in the island of Mutan, on account of his severity. His voyage round the world was written by one on board, and has been frequently printed in English. His suddenly converting to the Christian religion people whose language was unknown to him, as his was to them, is an absurdity that discredits this work.

Straits of MAGELLAN, a narrow passage between the island of Terra del Fuego and the southern extremity of the continent of America. This passage was first discovered by Ferdinand Magellan, who sailed through it into the South Sea, and from thence to the East Indies. Other navigators have passed the same way; but as these straits are exceedingly difficult, and subject to storms, it has been common to sail by Cape Horn, rather than through the Straits of Magellan. See *Straits Le Maire*, and *Terra del Fuego*.

MAGELLANIC-CLOUDS, whitish appearances like clouds, seen in the heavens towards the south pole, and having the same apparent motion as the stars. They are three in number, two of them near each other. The largest lies far from the south pole; but the other two are not many degrees more remote from it than the nearest conspicuous star, that is, about 11 degrees. Mr Boyl conjectures, that if these clouds were seen through a good telescope, they would appear to be multitudes of small stars, like the milky-way.

MAGGI (Jerome), in Latin *Magiur*, one of the most learned men of the 16th century, was born at Anghiari in Tuscany. He applied himself to all the sciences, and even to the art of war; and distinguished himself so much in this last study, that the Venetians sent him into the island of Cyprus in quality of judge of the admiralty. When the Turks besieged Famagusta, he performed all the services that could be expected from the most excellent engineer: he invented mines and machines for throwing fire, by means of which he destroyed all the works of the besiegers, and in an instant overthrew what had cost the Turks infinite labour. But they had their revenge; for, taking the city in 1571, they plundered his library, carried him loaded with chains to Constantinople, and treated him in the most inhuman and barbarous manner. He nevertheless comforted himself from the example of *Æsop*, *Menippus*, *Epictetus*, and other learned men; and, after passing the whole day in the meanest drudgery, he spent the night in writing. He composed, by the help of his memory alone, treatises filled with quotations, which he dedicated to the Imperial and French ambassadors. These ministers, moved by compassion for this learned man, resolved to purchase him.

him; but while they were treating for his ransom, Maggi found means to make his escape, and to get to the Imperial ambassador's house; when the Grand Vizir being enraged at his flight, and remembering the great mischief he had done the Turks during the siege of Famagusta, sent to have him seized, and caused him to be strangled in prison in 1572. His principal works are, 1. A treatise on the bells of the ancients. 2. On the destruction of the world by fire. 3. Commentaries on Æmilius Probus's lives of illustrious men. 4. Commentaries on the institutes. These works are written in elegant Latin. He also wrote a treatise on fortification in Italian; and a book on the situation of ancient Tuscany.

He ought not to be confounded with his brother *Bartholomew Maggi*, a physician at Bologna, who wrote a treatise of gun-shot wounds; nor with *Vincent Maggi*, a native of Bresse, and a celebrated professor of humanity at Ferrare in Padua, who was the author of several works.

MAGGOT, the common name of the fly-worm bred in flesh, from the egg of the great blue flesh-fly. Notwithstanding the distaste for this animal, its figure and structure of parts are greatly worth attending to; and may serve as a general history of the class of worms produced from the eggs of flies.

This animal is white and fleshy: its body is composed of a number of rings, like the bodies of caterpillars and other similar insects; and is capable, at the pleasure of the animal, of assuming different figures; being at times more or less extended in length, and consequently more or less thick.

Notwithstanding that this animal has no legs, it is able to move itself very swiftly; and in its first attempt to move its body, is extended to its greatest length, and assumes something of the figure of a pointed cone. The pointed part of the cone is the head of the animal, and is not separated from the next ring by any deeper furrow than the rest of the rings are from one another. In some flates of the animal, one may see two short horns thrust out from the head; but more generally two scaly hooks are observable: these are, however, sometimes hid, and have each of them a case or sheath; into which the animal can retract them at pleasure. These hooks are bent into an arch, the concavity of which is towards the plane on which the creature is placed; and they are thickest at their insertion in the head, and thence diminish gradually, till they terminate in a fine sharp point.

These two hooks are placed in a parallel direction, and can never come together, and therefore cannot serve in the place of teeth for grinding the food; but merely to pull and sever it in pieces, that it may be of a proper size for the mouth of the creature. Besides these hooks the maggot has a kind of dart, which is about a third part of their length, and is placed at an equal distance between them. This also is brown and scaly like them; it is quite straight, and terminates in a fine point. The hooks have as it were two scaly thorns at their points; and this dart seems intended, by reiterated strokes, to divide and break the pieces of flesh these have separated from the rest into smaller parts. Immediately below the apertures for the egress of the hooks, is placed the mouth of the animal; the creature does not show this little opening unless pres-

sed; but if the pressure is properly managed, it will sufficiently open it, and there may be discovered within it a small protuberance, which may very naturally be supposed either the tongue or the sucker of the animal. The hooks in these creatures not only supply the place of teeth, but also of legs; since it is by fastening these hooks into the substance it is placed on, and then drawing up its body to it, that it pulls itself along.

The back of this creature lowers itself by degrees as it approaches the extremity of the belly; and near the place where the back begins to lower itself, are placed the creature's two principal organs of respiration. One may perceive there two small roundish brown spots: they are very easily distinguishable by the naked eye, because the rest of the body of the creature is white; but if we take in the assistance of glasses, each of these spots appears to be a brown circular eminence raised a little above the rest of the body. On each of these spots one may also discover three oblong oval cavities, something of the shape of button-holes; these are situated in a parallel direction to one another, and their length nearly in a perpendicular direction to that of the body of the animal. These apertures are so many stigmata or air-holes; openings destined to admit the air necessary to the life of the animal. It has six of these stigmata, three in each side of its body.

The great transparency of the body of this animal gives us an opportunity also to distinguish that it has on each side a large white vessel running the whole length of the body. It is easy to follow the course of these vessels through their whole length, but they are, most distinct of all towards its hinder part; and they are always seen to terminate each in the brown part above mentioned: this leaves us no room to doubt that they are the two principal tracheæ.

The ramifications of the two great tracheæ are very beautifully seen in this creature, especially on its belly: and it is remarkable, that no vessel analogous to the great artery in the caterpillar class can be discovered in these; though, if there were any such, their great transparency must needs make them very easily distinguishable; nor could its dilatations and contractions, if so considerable as in that class of animals, be less so. See *ERUCA*.

Malpighi imagined, that this artery in the caterpillar class was a series of hearts; in its place, however, there may be seen in these animals a true heart. It is easy to observe in these creatures, about the fourth ring of their body, a small fleshy part, which has alternate contractions and dilatations; and is not only discoverable in the body by means of its transparency, but on making a proper section of them in the second, third, and fourth, will be thrown out of the body of the creature, and continue its beats for some time afterwards.

MAGI, or **MAGIANS**, an ancient religious sect in Persia, and other eastern countries, who maintained that there were two principles, one the cause of all good, the other the cause of all evil; and adorning the adoration of images, they worshipped God only by fire; which they looked upon as the brightest and most glorious symbol of Ormuzdes, or the good God; as darkness is the truest symbol of Arimanus, or the evil god. This religion was reformed by Zoroaster, who

maintained that there was one supreme independent Being; and under him two principles or angels, one the angel of goodness and light, and the other of evil and darkness: that there is a perpetual struggle between them, which shall last to the end of the world; that then the angel of darkness and his disciples shall go into a world of their own, where they shall be punished in everlasting darkness; and the angel of light and his disciples shall also go into a world of their own, where they shall be rewarded in everlasting light.

The priests of the magi were the most skilful mathematicians and philosophers of the ages in which they lived, inasmuch that a learned man and a magian became equivalent terms. The vulgar looked on their knowledge as supernatural; and hence those who practised wicked and mischievous arts, taking upon themselves the name of *magians*, drew on it that ill signification which the word magician now bears among us.

This sect still subsists in Persia under the denomination of *gouris*, where they watch the sacred fire with the greatest care, and never suffer it to be extinguished.

MAGIC, MAGIA, ΜΑΓΕΙΑ, in its ancient sense, the science or discipline and doctrine of the magi, or wise men of Persia. See MAGI.

The origin of magic and the magi is ascribed to Zoroaster. Salmastus derives the very name from Zoroaster, who, he says, was surnamed *Mog*, whence *Magus*. Others, instead of making him the author of the Persian philosophy, make him only the restorer and improver thereof; alleging, that many of the Persian rites in use among the magi were borrowed from the Zabihi among the Chaldeans, who agreed in many things with the magi of the Persians; whence some make the name *magus* common both to the Chaldeans and Persians. Thus Plutarch mentions, that Zoroaster instituted magi among the Chaldeans, in imitation whereof the Persians had theirs too.

MAGIC, in a more modern sense, is a science which teaches to perform wonderful and surprising effects.

The word *magic* originally carried with it a very innocent, nay, laudable meaning; being used purely to signify the study of wisdom, and the more sublime parts of knowledge; but in regard the ancient magi engaged themselves in astrology, divination, forcery, &c. the term *magic* in time became odious, and was only used to signify an unlawful and diabolical kind of science, depending on the assistance of the devil and departed souls.

If any wonder how so vain and deceitful a science should gain so much credit and authority over mens minds, Pliny gives the reason of it. It is, says he, because it has possessed itself of three sciences of the most esteem among men; taking from each all that is great and marvellous in it. Nobody doubts but it had its first origin in medicine; and that it insinuated itself into the minds of the people, under pretence of affording extraordinary remedies. To these fine promises it added every thing in religion that is pompous and splendid, and that appears calculated to blind and captivate mankind. Lastly, it mingled judicial astrology with the rest; persuading people, curious of futurity, that it saw every thing to come in the heavens.

Agrippa divides magic into three kinds; natural, celestial, and ceremonial or superstitious.

Natural MAGIC is no more than the application of natural active causes to passive subjects; by means whereof many surprising, but yet natural, effects are produced.

In this way many of our experiments in natural philosophy, especially those of electricity, optics, and magnetism, have a kind of magical appearance, and among the ignorant and credulous might easily pass for miracles. Such, without doubt, have been some of those miracles wrought by ancient magicians, whose knowledge of the various powers of nature, there is reason to believe, was much greater than modern vanity will sometimes allow †.

Baptista Porta has a treatise of natural magic, or of secrets for performing very extraordinary things by natural causes. The natural magic of the Chaldeans was nothing but the knowledge of the powers of simples and minerals. The magic which they called *theurgic*, consisted wholly in the knowledge of the ceremonies to be observed in the worship of the gods, in order to be acceptable. By virtue of these ceremonies they believed they could converse with spiritual beings, and cure diseases.

Celestial MAGIC, borders nearly on judiciary astrology: it attributes to spirits a kind of rule or dominion over the planets, and to planets a dominion over men; and on those principles builds a ridiculous kind of system. See ASTROLOGY.

Superstitious or Gothic MAGIC, consists in the invocation of devils. Its effects are usually evil and wicked, though very strange, and seemingly surpassing the powers of nature; supposed to be produced by virtue of some compact, either tacit or express, with evil spirits; but the truth is, these have not all the power that is usually imagined, nor do they produce those effects ordinarily ascribed to them.

This species of magic, there is every reason to believe, had its origin in Egypt, the native country of paganism. The first magicians mentioned in history were Egyptians; and that people so famed for early wisdom believed not only in the existence of demons, the great agents in magic (see DEMON), but also that different orders of those spirits presided over the elements of earth, air, fire, and water, as well as over the persons and affairs of men. Hence they ascribed every disease with which they were afflicted to the immediate agency of some evil demon. When any person was seized with a fever, for instance, they did not think it necessary to search for any natural cause of the disease; it was immediately attributed to some demon which had taken possession of the body of the patient, and which could not be ejected but by charms and incantations.

These superstitious notions, which had spread from Egypt over all the east, the Jews imbibed during their captivity in Babylon. Hence we find them in the writings of the New Testament attributing almost every disease to which they were incident to the immediate agency of devils (see POSSESSION). Many of the same impious superstitions were brought from Egypt and Chaldea by Pythagoras, and transmitted by him and his followers to the Platonists in Greece. This

† See *Stiff's*
Originals Sa-
cræ, book iii.
c. 2.

is apparent from the writers of the life of Pythagoras. Jamblicus, speaking of the followers of that philosopher, says expressly, that they cured certain diseases by incantations; and Porphyry adds, that they cured diseases both of the mind and of the body by songs and incantations. This was exactly the practice of the Egyptian priests, who were all supposed to keep up a constant intercourse with demons, and to have the power of controuling them by magical charms and sacred songs. Agreeably to this practice of his masters, we are told that Pythagoras directed certain diseases of the mind, doubtless those which he attributed to the agency of demons, to be cured partly by incantations, partly by magical hymns, and partly by music.—
 και τας ψυχας δι' ονομαστας περιμυθιστο τους μεν επιδασις και μετα-
 γιαιας τους δε μουσικην.

That there are different orders of created spirits,—whether called demons or angels,—whose powers intellectual and active greatly surpass the powers of man, reason makes probable, and revelation certain. Now it was the universal belief of the ancient nations, says the learned Mosheim †, and especially of the orientals, that certain sounds and words, for the most part barbarous, were highly grateful, and that others were equally disagreeable, to these spirits. Hence, when they wished to render a demon propitious, and to employ him on any particular office, the magicians composed their sacred songs of the words which were believed to be agreeable to him; and when it was their intention to drive him from themselves or others, they sung in a strain which they fancied a demon could not hear but with horror. From the same persuasion arose the custom of suspending from the neck of a sick person, whose disease was supposed to be inflicted by a demon, an amulet, sometimes made of gold and sometimes of parchment, on which was written one or more of those words which demons could not bear either to hear or to see: and in a didactic poem on the healing art still extant, we are taught by *Serenus Sammonicus*, that the word *ABRACADABRA* is an infallible remedy for a semiterren fever or ague; and to banish grief of heart, *Marcellinus* thinks nothing more effectual than the word *καρπαλαι*. In more modern times, as we are informed by *Agrippa*, the words used by those in compact with the devil, to invoke him, and to succeed in what they undertake, are, *Dier, mier, jesquet, benedoe-fet, douvima, eniteuau*. There are an hundred other formulas of words composed at pleasure, or gathered from several different languages, or patched from the Hebrew, or formed in imitation of it. And among the primitive Christians there was a superstitious custom, of which we suspect some remains may yet be found among the illiterate vulgar in different countries, of fastening to the neck of a sick person, or to the bed on which he lay, some text from the New Testament; and especially the first two or three verses of the gospel of St John, as a charm undoubtedly efficacious to banish the disease.

That magicians who could thus cure the sick, were likewise believed to have the power of inflicting diseases, and of working miracles, by means of their subservient demons, need not be doubted. Ancient writers of good credit are full of the wonders which they performed. We shall mention a few of those which are best attested, and inquire whether they might not

have been effected by other means than the interposition of demons.

The first magicians of whom we read are those who in Egypt opposed Moses. And we are told, that, when Aaron cast down his rod, and it became a serpent, they also did the like with their incantments; “for they cast down every man his rod, and they became serpents.” This was a phenomenon which, it must be confessed, had a very miraculous appearance; and yet there seems to have been nothing in it which might not have been effected by slight of hand. The Egyptians, and perhaps the inhabitants of every country where serpents abound, have the art of depriving them of their power to do mischief, so that they may be handled without danger. It was easy for the magicians, who were favoured by the court, to pretend that they changed their rods into serpents, by dexterously substituting one of those animals in place of the rod. In like manner they might pretend to change water into blood, and to produce frogs; for if Moses gave in these instances, as we know he did in others, any previous information of the nature of the miracles which were to be wrought, the magicians might easily provide themselves in a quantity of blood and number of frogs sufficient to answer their purpose of deceiving the people. Beyond this, however, their power could not go. It stopped where that of all workers in legerdemain must have stopped—at the failure of proper materials to work with. Egypt abounded with serpents; blood could be easily procured; and without difficulty they might have frogs from the river: But when Moses produced lice from the dust of the ground, the magicians, who had it not in their power to collect a sufficient quantity of these animals, were compelled to own this to be an effect of divine agency.

The appearance of Samuel to Saul at Endor is the next miracle, seemingly performed by the power of magic, which we shall consider. It was a common pretence of magicians, that they could raise up ghosts from below, or make dead persons appear unto them to declare future events; and the manner of their incantation is thus described by Horace:

— Pallor utraque

Fecerat horrenda aspectu. Scalpere terram
 Unguibus, et pullam divellere mordicus agnam
 Ceperunt: crur in fossam confusus, ut inde
 Manes elicerent, animas responsa datura.

“With yellings dire they fill’d the place,
 And hideous pale was either’s face.
 Soon with their nails they scrap’d the ground,
 And fill’d a magic trench profound
 With a black lamb’s thick-streaming gore,
 Whose members with their teeth they tore;
 That they might charm the sprites to tell
 Some curious anecdotes from hell.”

FRANCIS.

Whether the witch of Endor made use of such infernal charms as these, the sacred historian has not informed us; but Saul addressed her, as if he believed that by some form of incantation she could recall from the state of departed spirits the soul of the prophet who had been for some time dead. In the subsequent apparition, however, which was produced, some

† See his edition of *Cudworth's Intellectual System*.

some have thought that there was nothing more than a trick, by which a cunning woman imposed upon Saul's credulity, making him believe that some confident of her own was the ghost of Samuel. But had that been the case, he would undoubtedly have made the pretended Samuel's answer as pleasing to the king as possible, both to have her own life, which appears from the context to have been in danger, and likewise to have procured the larger reward. She would never have told her sovereign, the durst not have told him, that he himself should be shortly slain, and his sons with him; and that the host of Israel should be delivered into the hands of the Philistines. For this reason many critics, both Jewish and Christian, have supposed that the apparition was really a demon or evil angel, by whose assistance the woman was accustomed to work wonders, and to foretell future events. But it is surely very incredible, that one of the apostate spirits of hell should have upbraided Saul for applying to a *forcefess*, or should have accosted him in such words as these: "Why hast thou disquieted me, to bring me up? Wherefore dost thou ask of me, seeing the Lord is departed from thee, and is become thine enemy? For the Lord hath rent the kingdom out of thine hand, and given it to thy neighbour, even to David. Because thou obeydest not the voice of the Lord, therefore the Lord hath done this thing to thee this day." It is to be observed farther, that what was here denounced against Saul was really prophetic, and that the event answered to the prophecy in every particular. Now, though we do not deny that there are created spirits of penetration vastly superior to that of the most enlarged human understanding; yet we dare maintain, that no finite intelligence could by its own mere capacity have ever found out the precise time of the two armies engaging, the success of the Philistines, the consequences of the victory, and the very names of the persons that were to fall in battle. Saul and his sons were indeed men of tried bravery, and therefore likely to expose themselves to the greatest danger; but after the menaces which he received from the apparition, he would have been impelled, one should think, by common prudence, either to chicanery with the enemy, or to retire from the field without exposing himself, his sons, and the whole army, to certain and inevitable destruction; and his acting differently, with the consequences of his conduct, were events which no limited understanding could either foresee or certainly foretell. If to these circumstances we add the suddenness of Samuel's appearance, with the effect which it had upon the forcefess herself, we shall find reason to believe, that the apparition was that of no evil demon. There is not, we believe, upon record, another instance of any person's pretending to raise a ghost from below, without previously using some magical rites or some form of incantation. As nothing of that kind is mentioned in the case before us, it is probable that Samuel appeared before he was called. It is likewise evident from

the narrative, that the apparition was not what the woman expected; for we are told, that "when the saw Samuel, she cried out for fear." And when the king exhorted her not to be afraid, and asked what she saw, "the woman said, I see gods (*elohim*) ascending out of the earth." Now, had she been accustomed to do such feats, and known that what she saw was only her subservient demon, it is not conceivable that she could have been so frightened, or have mistaken her familiar for *elohim* in any sense in which that word can be taken. We are therefore strongly inclined to adopt the opinion of those who hold that it was Samuel himself who appeared and prophesied, not called up by the wretched woman or her demons, but, to her utter confusion, and the disgrace of her art, sent by God to rebuke Saul's madness in a most affecting and mortifying way, and to deter all others from ever applying to magicians or demons for assistance when refused comfort from heaven. For though this hypothesis may to a superficial thinker seem to transgress the rule of Horace—*Nec deus interfit*, &c.—which is as applicable to the interpretation of scripture, as to the introduction of supernatural agency in human compositions; yet he who has studied the theocratic constitution of Israel, the nature of the office which was there termed regal, and by what means the administration was in emergencies conducted, will have a different opinion, and at once perceive the *dignus vindice nodus*.

The sudden and wonderful destruction of the army of Breunus the Gaul, has likewise been attributed to magic, or, what in this inquiry amounts to the same thing, to the interposition of evil spirits, whom the priests of Apollo invoked as gods. Those barbarians had made an inroad into Greece, and invested the temple of Apollo at Delphi, with a view to plunder it of the sacred treasure. Their numbers and courage overpowered all opposition; and they were just upon the point of making themselves masters of the place, when, Justin informs us, that, to encourage the besieged, the priests and prophets "advenisse deum clamant; eumque se vidisse desilientem in templum per culminis aperta fastigia. Dum omnes opem dei suppliciter implorant, juvenem supra humanum modum insignis pulchritudinis, comiteseque ei duas armatas virgines, ex propinquis duabus Dianæ Minervæque ædibus occurrisse, nec oculis tantum hæc se perspicisse; audisse etiam stridorem arcus, ac strepitum armorum: proinde ne cunctarentur, diis antesignanis, hostem credere, et victoriæ deorum socios se adungere," fumis obscurationibus monebant. Quibus vocibus incensi, omnes certatim in prælium prosiliunt. Præsentiam Dei et ipsi statim sentire: nam et terræ motu portio montis abrupta Gallorum stravit exercitum, et confertissimi cunei non sine vulneribus hostium dissipati ruebant. Insecuta deinde tempestas est, quæ grandine et frigore faucios ex vulneribus absumpsit (A)."

This was unquestionably an extraordinary event; and

"(A) Called aloud that the god had arrived. That they had seen him leap into the temple through the aperture in the roof: That whilst they were all humbly imploring his help, a youth of more than human beauty, accompanied by two virgins in armour, had run to their assistance from the neighbouring temples of Diana and

Magic.

and it must be ascribed either to the immediate interposition of the Supreme Being, to natural means, or to the agency of demons: there is no other alternative. But it is altogether incredible that the Supreme Being should have miraculously interposed to defend the temple of a pagan divinity. It is very difficult to suppose that an earthquake, produced in the ordinary course of nature, should have been foretold by the priests, or that it could have happened so opportunely for the preservation of their treasure from the hands of fierce barbarians. Nothing, therefore, it has been said, remains, but either to allow the earthquake to have been produced by evil spirits, or to deny the truth of the historian's relation. But the catastrophe of Brennus's army is recorded in the same manner by so many ancient writers of good credit, that we cannot call in question their veracity: and therefore, being unwilling to admit the agency of demons into this affair, it will be incumbent on us to show by what human contrivance it might have been effected; for its arrival at so critical a juncture will not easily suffer us to suppose it a mere natural event.

Julian.

"The inclination of a Pagan priest (says Bishop Warburton†) to assist his god in extremity, will hardly be questioned; and the inclination of those at Delphi was not ill seconded by their public management and address. On the first rumour of Brennus's march against them, they issued orders, as from the oracle, to all the region round, forbidding the country people to secrete or bear away their wine and provisions. The effects of this order succeeded to their expectations. The half-starved barbarians finding, on their arrival in Phocis, so great a plenty of all things, made short marches, dispersed themselves over the country, and revelled in the abundance that was provided for them. This respite gave time to the friends and allies of the god to come to his assistance. Their advantages of situation likewise supported the measures which they had taken for a vigorous defence. The town and temple of Delphi were seated on a bare and cavernous rock, defended on all sides with precipices instead of walls. A large recess within assumed the form of a theatre; so that the shouts of soldiers, and the sounds of military instruments, re-echoing from rock to rock, and from cavern to cavern, increased the clamour to an immense degree; which, as the historian observes, could not but have great effects on ig-

No 191.

norant and barbarous minds. The playing off these panic terrors was not indeed of itself sufficient to repulse and dissipate a host of fierce and hungry invaders, but it enabled the defenders to keep them at bay till a more solid entertainment was provided for them, in the explosion and fall of that portion of the rock at the foot of which the greater part of the army lay encamped.

Magic.

"Among the caverns in the sacred rock, there was one which, from an intoxicating quality discovered in the steam which issued from it, was rendered very famous by being fitted to the recipient of the priestesses of Apollo (A). Now, if we only suppose this, or any other of the vapours emitted from the numerous fissures, to be endowed with that unctuous, or otherwise inflammatory quality, which modern experience shows to be common in mines and subterraneous places, we can easily conceive how the priests of the temple might, without the agency of demons, be able to work the wonders which history speaks of as effected in this transaction. For the throwing down a lighted torch or two into a chasm whence such a vapour issued, would set the whole into a flame; which, by suddenly rarifying and dilating the air, would, like fired gun-powder, blow up all before it. That the priests, the guardians of the rock, could be long ignorant of such a quality, or that they would divulge it when discovered, cannot be supposed. Strabo relates, that one *Onomarchus*, with his companions, as they were attempting by night to dig their way through to rob the holy treasury, were frightened from their work by the violent shaking of the rock; and he adds, that the same phenomenon had defeated many other attempts of the like nature. Now, whether the tapers which *Onomarchus* and his companions were obliged to use while they were at work, inflamed the vapour, or whether the priests of Apollo heard them at it, and set fire to a countermine, it is certain a quality of this kind would always stand them in stead. Such then (presumes the learned prelate) was the expedient (B) they employed to dislodge this nest of hornets, which had settled at the foot of their sacred rock; for the storm of thunder, lightning, and hail, which followed, was the natural effect of the violent concussions given to the air by the explosion of the mine."

Two instances more of the power of ancient magic we shall just mention, not because there is any thing

and Minerva; and that they had not only beheld these things with their eyes, but had also heard the whizzing of his bow and the clangor of his arms. They therefore earnestly exhorted the besieged not to neglect the heavenly signal, but to fall on upon their enemies, and partake with the divinities of the glory of the victory." With these words the soldiers being animated, eagerly rushed to battle: and were themselves quickly sensible of the presence of the god; for part of the rock being torn away by an earthquake, rolled down upon the Gauls; whose thickest battalions being thus thrown into confusion, fled, exposed to the weapons of their enemies. Soon afterwards a tempest arose, which by cold and the fall of hailstones cut off the wounded.

(A) "In hoc rupis anfractu, media ferme montis altitudine, planities exigua est, atque in ea profundum terræ foramen, quod in oraculo patet, ex quo frigidus spiritus, vi quadam velut vento in sublimem expulsiis, mentes satum in recordiam vertit, impletaque deo responsa consulentibus dare cogit." JUST. lib. 24. c. 10.

(B) The learned author, by arguments too tedious to be here enumerated, confirms the reasoning which we have borrowed from him; and likewise shows from history, that the priests, before they came to extremities with the sacred rock, had entered into treaty with those barbarians, and paid them a large tribute to decamp and quit the country. This adds greatly to the probability of his account of the explosion; for nothing but the absolute impossibility of getting quit of their besiegers by any other means, could have induced the priests to hazard an experiment so big with danger to themselves as well as to their enemies.

thing particular or important in the facts, but because some credit seems to have been given to the narration by the discerning Cudworth. Philostratus, in his life of Apollonius Tyanæus, informs us, that a *laughing Demoniac* at Athens was cured by that magician, who ejected the evil spirit by threats and menaces; and the biographer adds, that the demon, at his departure, is said to have overturned a statue which stood before the porch where the cure was performed. The other instance is of the same magician freeing the city of Ephesus from the *plague* by stoning to death an old ragged beggar whom Apollonius called the *plague*, and who appeared to be a *demon* by his changing himself into the form of a *blagged dog*.

That such tales as these should have been thought worthy of the slightest notice by the incomparable author of the Intellectual System, is indeed a wonderful phenomenon in the history of human nature. The whole story of Apollonius Tyanæus, as is now well known, is nothing better than a collection of the most extravagant fables; but were the narrative such as that credit could be given to the facts here related, there appears no necessity in either case for calling in the agency of evil spirits by the power of magic.—The Athenians of that age were a superstitious people. Apollonius was a shrewd impostor, long practised in the art of deceiving the multitude. For such a man it was easy to persuade a friend and confidant to act the part of the *laughing demoniac*; and without much difficulty the statue might be so undermined as inevitably to tumble upon a violent concussion being given to the ground at the time of the departure of the pretended demon. If so, this feat of magic dwindles down into a very trifling trick performed by means both simple and natural. The other case of the poor man at Ephesus, who was stoned to death, is exactly similar to that of those innocent women in our own country, whom the vulgar in the last century were incited to burn for the supposed crime of witchcraft. We have no reason to suppose that an Ephesian mob was less inflammable or credulous than a British mob, or that Apollonius played his part with less skill than a Christian demonologist; and as the spirits of our witches, who were sacrificed to folly and fanaticism, were often supposed to migrate from their dead bodies into the bodies of *bares* or *cats* accidentally passing by, so might this impostor at Ephesus persuade his cruel and credulous instruments, that the spirit of their victim had taken possession of the body of the *blagged dog*.

Still it may be said, that in *magic* and *divination* events have been produced out of the ordinary course of nature; and as we cannot suppose the Supreme Being to have countenanced such abominable practices by the interposition of his power, we must necessarily attribute those effects to the agency of demons, or evil spirits. Thus, when Æneas consulted the Sybil, the agency of the inspiring god changed her whole appearance:

“Poscere fata

Tempus,” ait: “Deus, ecce, Deus.” Cui talia tanti
Ante fores, subito non vultus, non color unus,
Non compe manere comæ: sed pectus anhelum,
Et rabie fera corda tumunt; majorque videri,

Vol. X. Part II.

Nec mortale sonans: afflata est numine quando
Jam propiore Dei.

“Aloud she cries,
“This is the time, inquire your destinies.
He comes, behold, a god!” Thus while she said,
And shivering at the sacred entry laid,
Her colour chang’d, her face was not the same,
And hollow groans from her deep spirit came:
Her hair stood up; convulsive rage possess’d
Her trembling limbs, and heav’d her lab’ring breast;
Greater than human kind the seem’d to look,
And with an accent more than mortal spoke.
Her staring eyes with sparkling fury roll,
When all the God came rushing on her soul.”

DRYDEN.

In answer to this, it is to be observed, that the temple of Apollo at Cumæ was an immense excavation in a solid rock. The rock was probably of the same kind with that on which the temple of Delphi was built, full of fissures, out of which exhaled perpetually a poisonous kind of vapour. Over one of these fissures was the tripod placed, from which the priestess gave the oracle. Now we learn from St Chrysostom, that the priestess was a woman: “Que in tripodes sedens expansa malignum spiritum per interna immisum, et per genitales partes subeuntem excipiens, furore repletur, ipsaque resolutis crinibus baccharatur, ex ore spumam emittens, et sic furoris verba loquebatur.” By comparing this account with that quoted above from Justin, which is confirmed both by Pausanias and by Strabo, it is evident, that what Chrysostom calls *malignum spiritum* was a particular kind of vapour blown forcibly through the fissure of the rock. But if there be a vapour of such a quality as, if received per *partes genitales*, would make a woman furious, there is surely no necessity for calling into this scene at Cumæ the agency of a demon or evil spirit. Besides, it is to be remembered, that in all mystical and magical rites, such as this was, both the priests, and the persons consulting them prepared themselves by particular kinds of food, and sometimes, as there is reason to believe, by human sacrifices; for the approach of the god or demon whose aid they invoked. On the present occasion, we know from the poet himself, that a cake was used which was composed of poppy-seed and honey; and Plutarch speaks of

a shrub called *leucophyllus*, used in the celebration of the mysteries of Hecate, which drives men into a kind of frenzy, and makes them confess all the wickedness which they had done or intended. This being the case, the illusions of fancy occasioned by poppy will sufficiently account for the change of the Sybil’s appearance, even though the inhaled vapour should not have possessed that efficacy which Chrysostom and Justin attribute to it. Even some sorts of our ordinary food occasion strange dreams, for which onions in particular are remarkable. Excessive drunkenness, as is well known, produces a disorder named by the bacchanalians of this country the *blue devils*, which consists of an immense succession of spectres, accompanied with extreme horror to the person who sees them. From these facts, which cannot be denied, there must arise a suspicion, that by using very unnatural food, such as human blood, the vilest of insects,

Magic.

serpents, and medicated cakes, by shutting themselves up in solitudes and caves, and by devising every method to excite horrid and dreadful ideas or images in the fancy, the ancient magicians might by natural means produce every phenomenon which they attributed to their gods or demons. Add to this, that in ancient times magic was studied as a science. Now, as we cannot suppose that every one who studied it intended absolutely nothing, or that all who believed in it were *wholly* deceived; what can we infer, but that the science consisted in the knowledge of those drugs which produced the phantoms in the imagination, and of the method of preparing and properly employing them for that purpose? The celebrated Friar Bacon indeed, as far back as the 13th century, wrote a book *de Nullitate Magia*; but though we should allow that this book proved to demonstration, that in his time no such thing as magic existed, it never could prove that the case had always been so. At that time almost all the sciences were lost; and why not magic as well as others? It is likewise an undoubted fact, that magic at all times prevailed among the Asiatics and Africans more than among the Europeans. The reason doubtless was, that the former had the requisites for the art in much greater perfection than we. Human sacrifices were frequent among them; they had the most poisonous serpents, and the greatest variety of vegetable poisons, together with that powerful narcotic opium; all which were of essential use in mythical and magic rites. They had, besides, a burning sun, frightful deserts and solitudes; which, together with extreme fasting, were all called into their assistance, and were sufficient to produce, by natural means, the most wonderful phenomena which have ever been attributed to magical incantations. Even in our own days, we have the testimony of two travellers, whom we cannot suspect to be either liars or enthusiasts, that both the Indians and Africans perform feats for which neither they nor the most enlightened Europeans can account. The one is Mr Grose, who visited the East Indies about the year 1762; and the other is Mr Bruce, who informs us, that the inhabitants of the western coast of Africa pretend to hold a communication with the devil, and verify their assertions in such a manner that neither he nor other travellers know what to make of it: but it does not from this follow, that Mr Bruce believed that communication to be real. We have all seen one of the most illiterate men that ever assumed the title of *Doctor*, perform feats very surprising, and such as even a philosopher would have been puzzled to account for, if he had not been previously let into the secret; and yet no man supposes that *Katterfelto* holds any communication with the devil, although he has sometimes pretended it among people whose minds he supposed unenlightened.

Still it may be objected, that we have a vast number of histories of witches, who in the last century confessed, that they were present with the devil at certain meetings; that they were carried through the air, and saw many strange feats performed, too numerous and too ridiculous to be here mentioned. The best

answer to this objection seems to be that given by Dr Ferriar in his essay on Popular Illusions*. "The solemn meeting of witches (says he) are supposed to be put beyond all doubt by the numerous confessions of criminals, who have described their ceremonies, named the times and places of their meetings with the persons present, and who have agreed in their relations, though separately delivered. But I would observe, first, that the circumstances told of those festivals are in themselves ridiculous and incredible; for they are represented as gloomy and horrible, and yet with a mixture of childish and extravagant fancies, more likely to disgust and alienate than conciliate the minds of their guests. They have every appearance of uneasy dreams. Sometimes the devil and his subjects *say mass*; sometimes he *preaches* to them; more commonly he was seen in the form of a *black goat*, surrounded by imps in a thousand frightful shapes; but none of these forms are *new*, they all resemble known quadrupeds or reptiles. Secondly, I observe, that there is direct proof furnished even by demonologists, that all those supposed journeys and entertainments were nothing more than dreams. Persons accused of witchcraft have been repeatedly watched about the time they had fixed for their meeting: they have been seen to anoint themselves with soporific compositions; after which they fell into profound sleep; and on awaking several hours afterwards, they have related their journey through the air, with their amusement at the festival, and have named the persons whom they saw there." This is exactly conformable to the practice of the ancient magicians and diviners, and seems to be the true way of accounting, as well for many of the phenomena of magic, as for that extravagant and shameful superstition which prevailed so much during part of the last century, and by which such numbers of innocent men and women were cruelly put to death (c). We may indeed be assured, that the devil has it not in his power to reverse in a single instance the laws of nature without a divine permission; and we can conceive but one occasion (see *POSSESSION*) on which such permission could be given consistently with the wisdom and the goodness of God. All the tales, therefore, of diabolical agency in magic and witchcraft must undoubtedly be false; for a power which the devil is not himself at liberty to exert, he cannot communicate to a human creature. Were the case otherwise; were those powers, "which (according to Johnson) only the controul of Omnipotence restrains from laying creation waste, subservient to the invocations of wicked mortals; were those spirits,—

— of which the least could wield

The elements, and arm him with the force

Of all their regions,"—permitted to work miracles, and either to inflict or to remove diseases at the desire of their capricious votaries, how comfortable and wretched would be the life of men! But the matter has been long ago determined by the failure of Pharaoh's magicians; who, though by legerdemain they imitated some of the miracles of Moses, could not form the vilest insect, or stand before the disease which he inflicted upon them as well as upon others.

The

Magic.

Manchester
Transactions, vol. 3.

(c) For some farther account of popular illusions, see *Animal MAGNETISM*.

Magic
Square.

The revival of learning, and the success with which the laws of nature have been investigated, have long ago banished this species of magic from all the enlightened nations of Europe. Among ourselves, none but persons grossly illiterate pay the least regard to magical charms; nor are they any where abroad more prevalent than among the inhabitants of Lapland and Iceland. These people, indeed, place an absolute confidence in the effects of certain idle words and actions; and ignorant fallows from other parts of the world are deceived by their assertions and their ceremonies. The famous *magical drum* of the Laplanders is still in constant use in that nation; and Scheffer, in his History of Lapland, has given an account of its structure.

This instrument is made of beech, pine, or fir, split in the middle, and hollowed on the flat side where the drum is to be made. The hollow is of an oval figure; and is covered with a skin clean dressed, and painted with figures of various kinds, such as stars, suns and moons, animals and plants, and even countries, lakes and rivers; and of later days, since the preaching of Christianity among them, the acts and sufferings of our Saviour and his apostles are often added among the rest. All these figures are separated by lines into three regions or clusters.

There is, besides these parts of the drum, an index and a hammer. The index is a bundle of brags or iron rings, the biggest of which has a hole in its middle, and the smaller ones are hung to it. The hammer or drumstick is made of the horn of a rein-deer; and with this they beat the drum so as to make these rings move, they being laid on the top for that purpose. In the motion of these rings about the pictures figured on the drum, they fancy to themselves some prediction in regard to the thing they inquire about.

What they principally inquire into by this instrument, are three things. 1. What sacrifices will prove most acceptable to their gods. 2. What success they shall have in their several occupations, as hunting, fishing, curing of diseases, and the like; and, 3. What is doing in places remote from them. On these several occasions they use several peculiar ceremonies, and place themselves in various odd postures as they beat the drum; which influences the rings to the one or the other side, and to come nearer to the one or the other set of figures. And when they have done this, they have a method of calculating a discovery, which they keep as a great secret, but which seems merely the business of the imagination in the diviner or magician.

Magic Square, a square figure, formed of a series of numbers in mathematical proportion; so disposed in parallel and equal ranks, as that the sums of each row, taken either perpendicularly, horizontally, or diagonally, are equal.

Let the several numbers which compose any square number (for instance, 1, 2, 3, 4, 5, &c. to 25 inclusive, the square number) be disposed, in their natural order, after each other in a square figure of 25 cells, each in its cell; if now you change the order of these numbers, and dispose them in the cells in such manner, as that the five numbers which fill an horizontal rank of cells, being added together, shall make the same sum with the five numbers in any other rank of cells, whether

horizontal or vertical, and even the same number with the five in each of the two diagonal ranks: this disposition of numbers is called a *magic square*, in opposition to the former disposition, which is called a *natural square*. See the figures following:

Natural square.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

Magic square.

16	14	8	2	25
3	22	20	11	9
15	6	4	23	17
24	18	12	10	1
7	5	21	19	13

One would imagine that these magic squares had that name given them in regard this property of all their ranks, which, taken any way, make always the same sum, appeared extremely surprising, especially in certain ignorant ages, when mathematics passed for magic; but there is a great deal of reason to suspect, that these figures merited their name still further, by the superfluous operations they were employed in, as the construction of talismans, &c. for, according to the childish philosophy of those days, which attributed virtues to numbers, what virtues might not be expected from numbers so wonderful?

However, what was at first the vain practice of makers of talismans and conjurers, has since become the subject of a serious research among mathematicians; not that they imagine it will lead them to any thing of solid use or advantage. Magic squares favour too much of their original to be of much use; but only as it is a kind of play, where the difficulty makes the merit, and it may chance to produce some new views of numbers, which mathematicians will not lose the occasion of.

Eman. Moschopolus, a Greek author of no great antiquity, is the first that appears to have spoken of magic squares: and by the age wherein he lived, there is reason to imagine he did not look on them merely as a mathematician. However, he has left us some rules for their construction. In the treatise of Cor. Agrippa, so much accused of magic, we find the squares of seven numbers, viz. from three to nine inclusive, disposed magically; and it must not be supposed that those seven numbers were preferred to all the other without some very good reason: in effect, it is because their squares, according to the system of Agrippa and his followers, are planetary. The square of 3, for instance, belongs to Saturn; that of 4 to Jupiter; that of 5 to Mars; that of 6 to the Sun; that of 7 to Venus; that of 8 to Mercury; and that of 9 to the Moon. M. Bachet applied himself to the study of magic squares, on the hint he had taken from the planetary squares of Agrippa, as being unacquainted with the work of Moschopolus, which is only in manuscript in the French king's library; and, without the assistance of any author, he found out a new method for those squares whose root is uneven, for instance 25, 49, &c. but he could not make any thing of those whose root is even.

After him came M. Frenicle, who took the same subject in hand. A certain great algebraist was of opinion, that whereas the 16 numbers which compose the square might be disposed 20922789888000 different ways in a natural square (as from the rules of com-

Magic
Square.

bination it is certain they may¹, they could not be disposed in a magic square above 16 different ways; but M. Frenicle showed, that they might be thus disposed 878 different ways: whence it appears how much his method exceeds the former, which only yielded the 55th part of magic squares of that of M. Frenicle.

To this inquiry he thought fit to add a difficulty that had not yet been considered: the magic square of 7, for instance, being constructed, and its 49 cells filled, if the two horizontal ranks of cells, and, at the same time, the two vertical ones, the most remote from the middle, be retrenched; that is, if the whole border or circumference of the square be taken away, there will remain a square whose root will be 5, and which will only consist of 25 cells. Now it is not at all surprising that the square should be no longer magical, because the ranks of the large ones were not intended to make the same sum, excepting when taken entire with all the seven numbers that fill their seven cells; so that being mutilated each of two cells, and having lost two of their numbers, it may be well expected, that their remainders will not any longer make the same sum. But M. Frenicle would not be satisfied, unless when the circumference or border of the magic square was taken away, and even any circumference at pleasure, or, in fine, several circumferences at once, the remaining square was still magical: which last condition, no doubt, made these squares vastly more magical than ever.

Again, he inverted that condition, and required that any circumference taken at pleasure, or even several circumferences, should be inseparable from the square; that is, that it should cease to be magical when they were removed, and yet continue magical after the removal of any of the rest. M. Frenicle, however, gives no general demonstration of his methods, and frequently seems to have no other guide but chance. It is true, his book was not published by himself, nor did it appear till after his death, viz. in 1693.

In 1733, M. Poignard, canon of Brussels, published a treatise of sublime magic squares. Before him there had been no magic squares made but for serieses of natural numbers that formed a square; but M. Poignard made two very considerable improvements. 1. Instead of taking all the numbers that fill a square, for instance the 36 successive numbers, which would fill all the cells of a natural square, whose side is 6, he only takes as many successive numbers as there are units in the side of the square, which, in this case, are six; and these six numbers alone he disposes in such manner in the 36 cells that none of them are repeated twice in the same rank, whether it be horizontal, vertical, or diagonal; whence it follows, that all the ranks, taken all the ways possible, must always make the same sum, which M. Poignard calls repeated progression. 2. Instead of being confined to take these numbers according to the series and succession of the natural numbers, that is, in an arithmetical progression, he takes them likewise in a geometrical progression, and even in an harmonical progression. But with these two last progressions the magic must necessarily be different to what it was: in the squares filled with numbers in

geometrical progression, it consists in this, that the products of all the ranks are equal; and in the harmonical progression, the numbers of all the ranks continually follow that progression. he makes squares of each of these three progressions repeated.

This book of M. Poignard gave occasion to M. de la Hire to turn his thoughts the same way, which he did with such success, that he seems to have well nigh completed the theory of magic squares. He first considers uneven squares: all his predecessors on the subject having found the construction of even ones by much the most difficult; for which reason M. de la Hire reserves those for the last. This excess of difficulty may arise partly from hence, that the numbers are taken in arithmetical progression. Now in that progression, if the number of terms be uneven, that in the middle has some properties, which may be of service; for instance, being multiplied by the number of terms in the progression, the product is equal to the sum of all the terms.

M. de la Hire proposes a general method for uneven squares, which has some similitude with the theory of compound motions, so useful and fertile in mechanics. As that consists in decomposing motions, and resolving them into others more simple; so does M. de la Hire's method consist in resolving the square that is to be constructed into two simple and primitive squares. It must be owned, however, it is not quite so easy to conceive those two simple and primitive squares in the compound or perfect square, as in an oblique motion to imagine a parallel and perpendicular one.

Suppose a square of cells, whose root is uneven, for instance 7; and that its 49 cells are to be filled magically with numbers, for instance the first 7. M. de la Hire, on the one side, takes the first 7 numbers, beginning with unity, and ending with the root 7; and on the other 7, and all its multiples to 49, exclusively; and as these only make six numbers, he adds 6, which makes this an arithmetical progression of 7 terms as well as the other; 0. 7. 14. 21. 28. 35. 42. This done, with the first progression repeated, he fills the square of the root 7 magically: In order to this, he writes in the first seven cells of the first horizontal rank the seven numbers proposed in what order he pleases, for that is absolutely indifferent; and it is proper to observe here, that those seven numbers may be ranged in 5040 different manners in the same rank. The order in which they are placed in the first horizontal rank, be it what it will, is that which determines their order in all the rest. For the second horizontal rank, he places in its first cell, either the third, the fourth, the fifth, or the sixth number, from the first number of the first rank; and after that writes the six others in order as they follow. For the third horizontal rank, he observes the same method with regard to the second that he observed in the second with regard to the first, and so of the rest. For instance, suppose the first horizontal rank filled with the seven numbers in their natural order, 1, 2, 3, 4, 5, 6, 7; the second horizontal rank may either commence with 3, with 4, with 5, or with 6: but in this instance it commences with 3; the third rank therefore must com-

Magic
Square.

1	2	3	4	5	6	7
3	4	5	6	7	1	2
5	6	7	1	2	3	4
7	1	2	3	4	5	6
2	3	4	5	6	7	1
4	5	6	7	1	2	3
6	7	1	2	3	4	5

ten down in the order wherein they stand in the first, going on to 5, 6, and 7, and returning to 1, 2, &c. till every number in the first rank be found in every rank underneath, according to the order arbitrarily pitched upon at first. By this means it is evident, that no number whatever can be repeated twice in the same rank; and by consequence, that the seven numbers 1, 2, 3, 4, 5, 6, 7, being in each rank, must of necessity make the same sum.

It appears, from this example, that the arrangement of the numbers in the first rank being chosen at pleasure, the other ranks may be continued in four different manners: and since the first rank may have 5040 different arrangements, there are no less than 20160 different manners of constructing the magic square of seven number-repeated.

1	2	3	4	5	6	7
2	3	4	5	6	7	1
3	4	5	6	7	1	2
4	5	6	7	1	2	3
5	6	7	1	2	3	4
6	7	1	2	3	4	5
7	1	2	3	4	5	6

1	2	3	4	5	6	7
7	1	2	3	4	5	6
6	7	1	2	3	4	5
5	6	7	1	2	3	4
4	5	6	7	1	2	3
3	4	5	6	7	1	2
2	3	4	5	6	7	1

The order of the numbers in the first rank being determined; if in beginning with the second rank, the second number 2, or the last number 7, should be pitched upon, in one of those cases and repeated; and in the other case, the other diagonal would be false unless the number repeated seven times should happen to be 4; for four times seven is equal to the sum of 1, 2, 3, 4, 5, 6, 7: and in general, in every square consisting of an unequal number of terms, in arithmetical progression, one of the diagonals would be false according to those two constructions, unless the term always repeated in that diagonal were the middle term of the progression. It is not, however, at all necessary to take the terms in an arithmetical progression; for, according to this method, one may construct a magic square of any numbers at pleasure, whether they be according to any certain progression or not. If they be in an arithmetical progression, it will be proper, out of the general method, to except those two constructions which produce a continual repetition of the same term in one of the two diagonals, and only to take in the case wherein that repetition would prevent the diagonal from being just; which case being absolutely disregarded when we computed that the square of 7 might have 20,160 different constructions, it is evident that by taking that case in it must have vastly more.

To begin the second rank with any other number

mence with 5, the fourth with 7, the fifth with 2, the sixth with 4, and the seventh with 6. The commencement of the ranks which follow the first being thus determined, the other numbers, as we have already observed, must be written

besides the second and the last, must not, however, be looked on as an universal rule: it holds good for the square of 7; but if the square of 9, for instance, were to be constructed, and the fourth figure of the first horizontal rank were pitched on for the first of the second, the consequence would be, that the fifth and eighth horizontal ranks would likewise commence with the same number, which would therefore be repeated three times in the same vertical rank, and occasion other repetitions in all the rest. The general rule, therefore, must be conceived thus: Let the number in the first rank pitched on, for the commencement of the second, have such an exponent of its quota; that is, let the order of its place be such, as that if an unit be taken from it, the remainder will not be any just quota part of the root of the square; that is, cannot divide it equally. If, for example, in the square of 7, the third number of the first horizontal rank be pitched on for the first of the second, such construction will be just; because the exponent of the place of that number, viz. 3, subtracting 1, that is, 2, cannot divide 7. Thus also might the fourth number of the same first rank be chosen, because 4—1, viz. 3, cannot divide 7; and, for the same reason, the fifth or sixth number might be taken: but in the square of 9, the fourth number of the first rank must not be taken, because 4—1, viz. 3, does divide 9. The reason of this rule will appear very evidently, by considering in what manner the returns of the same numbers do or do not happen, taking them always in the same manner in any given series. And hence it follows, that the fewer divisions the root of any square to be constructed has, the more different manners of constructing it there are; and that the prime numbers, i. e. those which have no divisions, as 5, 7, 11, 13, &c. are those whose squares will admit of the most variations in proportion to their quantities.

The squares constructed according to this method have some particular properties not required in the problem; for the numbers that compose any rank parallel to one of the two diagonals, are ranged in the same order with the numbers that compose the diagonal to which they are parallel. And as any rank parallel to a diagonal must necessarily be shorter, and have fewer cells than the diagonal itself, by adding to it the correspondent parallel, which has the number of cells by which the other falls short of the diagonal, the numbers of those two parallels, placed as it were end to end, still follow the same order with those of the diagonal: besides that their sums are likewise equal; so that they are magical on another account. Instead of the squares, which we have hitherto formed by horizontal ranks, one might also form them by vertical ones; the case is the same in both.

All we have hitherto said regards only the first primitive square, whose numbers, in the proposed example, were 1, 2, 3, 4, 5, 6, 7; here still remains the

Magic
Sq. ard.

First Primitive.

1	2	3	4	5	6	7
3	4	5	6	7	1	2
5	6	7	1	2	3	4
7	1	2	3	4	5	6
2	3	4	5	6	7	1
4	5	6	7	1	2	3
6	7	1	2	3	4	5

second.

Second Primitive.

0	7	14	21	28	35	42
21	28	35	42	0	7	14
42	0	7	14	21	28	35
14	21	28	35	42	0	7
35	42	0	7	14	21	28
7	14	21	28	35	42	0
28	35	42	0	7	14	21

second primitive, whose numbers are 0, 7, 14, 21, 28, 35, 42. M. de la Hire proceeds in the same manner here as in the former; and this may likewise be constructed in 20,160 different manners, as containing the same number of terms with the first. Its construction being made, and of consequence all its ranks making the same sum, it is evident, that if we bring the two into one, by adding together the numbers of the two corresponding cells of the two squares, that is, the two numbers of the first of each, the two numbers of the second, of the third, &c. and dispose them in the 49 corresponding cells of a third square, it will likewise be magical in regard to its rank, formed by the addition of equal sums to equal sums, which must of necessity be equal among themselves. All that remains in doubt is, whether or no, by the addition of the corresponding cells of the two first squares, all the cells of the third will be filled in such manner, as that each not only contains one of the numbers of the progression from 1 to 49, but also that this number be different from any of the rest, which is the end and design of the whole operation.

As to this it must be observed, that if in the construction of the second primitive square care has been taken, in the commencement of the second horizontal rank, to observe an order with regard to the first different from what was observed in the construction of the first square; for instance, if the second rank of the first square began with the

Perfect Square.

1	9	17	25	33	41	49
24	37	40	48	7	8	16
47	6	14	15	23	31	39
21	22	41	38	45	1	13
37	47	4	12	20	28	29
11	19	27	3	36	46	3
34	42	43	21	10	18	26

third term of the first rank, and the second rank of the second square commence with the fourth of the first rank, as in the example it actually does; each number of the first square may be combined once, and only once, by addition with all the numbers of the second.

And as the numbers of the first are here 1, 2, 3, 4, 5, 6, 7, and those of the second, 0, 7, 14, 21, 28, 35, 42, by combining them in this manner we have all the numbers in the progression from 1 to 49, without having any of them repeated; which is the perfect magic square proposed.

The necessity of constructing the two primitive squares in a different manner does not at all hinder but that each of the 20,160 constructions of the one may be combined with all the 20,160 constructions of the other: of consequence, therefore, 20,160 multiplied by itself, which makes 406,425,600, is the number of different constructions that may be made of the perfect square, which here consists of the 49 numbers of the natural progression. But as we have already observed, that a primitive square of seven numbers repeated may have above 20,160 several constructions, the number 406,425,600 must come vastly short of expressing all the possible constructions of a perfect magic square of the 49 first numbers.

As to the even squares, he constructs them like the uneven ones, by two primitive squares; but the con-

struction of primitives is different in general, and may be to a great number of ways: and those general differences admit of a great number of particular variations, which give as many different constructions of the same even square. It scarce seems possible to determine exactly, either how many general differences there may be between the construction of the primitive squares of an even square and an uneven one, nor how many particular variations each general difference may admit of; and, of consequence, we are still far from being able to determine the number of different constructions of all those that may be made by the primitive squares.

The ingenious Dr Franklin seems to have carried this curious speculation farther than any of his predecessors in the same way. He has constructed not only a magic square of squares, but likewise a magic circle of circles, of which we shall give some account for the amusement of our readers. The magic square of squares is formed by dividing the great square, as in

Plate 294. fig. 1. The great square is divided into 256 small squares, in which all the numbers from 1 to 256 are placed in 16 columns, which may be taken either horizontally or vertically. The properties are as follow:

1. The sum of the 16 numbers in each column, vertical and horizontal, is 2056.
2. Every half column, vertical and horizontal, makes 1028, or half of 2056.
3. Half a diagonal ascending added to half a diagonal descending, makes 2056; taking these half diagonals from the ends of any side of the square to the middle thereof; or by reckoning them either upward or downward, or sideways from left to right hand, or from right to left.
4. The same, with all the parallels to the half diagonals, as many as can be drawn in the great square: for any two of them being directed upward and downward, from the place where they begin to that where they end, their sums will make 2056. The same downward and upward in like manner: or all the same if taken sideways to the middle, and back to the same side again. N. B. One set of these half diagonals and their parallels is drawn in the same square upward and downward. Another such set may be drawn from any of the other three sides.

5. The four corner numbers in the great square, added to the four central numbers therein, make 1028; equal to the half sum of any vertical or horizontal column which contains 16 numbers; and equal to half a diagonal or its parallel.

6. If a square hole (equal in breadth to four of the little squares) be cut in a paper, through which any of the 16 little squares in the great square may be seen, and the paper be laid on the great square, the sum of all the 16 numbers, seen through the hole, is equal to the sum of the 16 numbers in any horizontal or vertical column, viz. to 2056.

The magic circle of circles (fig. 2.) is composed of a series of numbers from 12 to 75 inclusive, divided into eight concentric circular spaces, and ranged in eight radii of numbers, with the number 12 in the centre; which number, like the centre, is common to all these circular spaces, and to all the radii.

Magic
Square.

The numbers are so placed, that the sum of all those in either of the concentric circular spaces above mentioned, together with the central number 12, make 360; equal to the number of degrees in a circle.

The numbers in each radius also, together with the central number 12, make just 360.

The numbers in half of any of the above circular spaces, taken either above or below the double horizontal line, with half the central number 12, make 180; equal to the number of degrees in a semicircle.

If any four adjoining numbers be taken, as if in a square, in the radial divisions of these circular spaces, the sum of these, with half the central number, make 180.

There are, moreover, included, four sets of other circular spaces, bounded by circles which are eccentric with respect to the common centre; each of these sets containing five spaces. The centres of the circles which bound them are at A, B, C, and D. The set whose centre is at A is bounded by dotted lines; the set whose centre is at C is bounded by lines of short unconnected strokes; and the set round D is bounded by lines of unconnected longer strokes, to distinguish them from one another. In drawing this figure by hand, the set of concentric circles should be drawn with black ink, and the four different sets of eccentric circles with four kinds of ink of different colours; as blue, red, yellow, and green, for distinguishing them readily from one another. These sets of eccentric circular spaces intersect those of the concentric, and each other; and yet the numbers contained in each of the eccentric spaces, taken all around through any of the 20 which are eccentric, make the same sum as those in the concentric, namely 360, when the central number 12 is added. Their halves also, taken above or below the double horizontal line, with half the central number, make 180.

Observe, that there is not one of the numbers but what belongs at least to two of the circular spaces, some to three, some to four, some to five; and yet they are all so placed as never to break the required number 360 in any of the 28 circular spaces within the primitive circle.

To bring these matters in view, all the numbers as above mentioned are taken out, and placed in separate columns as they stand around both the concentric and eccentric circular spaces, always beginning with the outermost and ending with the innermost of each set, and also the numbers as they stand in the eight radii, from the circumference to the centre; the common central number 12 being placed the lowest in each column.

1. In the eight concentric circular spaces.

14	72	23	65	21	67	12	74
25	63	16	70	18	68	27	61
30	56	39	49	37	51	28	58
41	47	32	54	34	52	43	45
46	40	55	33	53	35	44	42
57	31	48	38	50	46	59	29
62	24	71	17	69	19	60	26
73	15	64	22	66	20	75	13
12	12	12	12	12	12	12	12
360	360	360	360	360	360	360	360

2. In the eight radii.

14	25	30	41	46	57	62	73
72	63	56	47	40	31	24	15
23	16	39	32	55	48	71	64
65	70	49	54	33	38	17	22
31	18	37	34	53	50	69	66
67	68	51	52	35	36	19	20
12	27	28	43	44	59	60	75
74	61	58	45	42	29	26	13
12	12	12	12	12	12	12	12
360	360	360	360	360	360	360	360

Magic
Square.

3. In the five eccentric circular spaces whose centre is at A.

14	72	23	85	21
63	16	70	18	68
39	49	37	51	28
54	34	52	43	45
33	53	35	44	42
48	38	50	36	59
24	71	17	69	19
73	15	64	22	66
12	12	12	12	12

4. In the five eccentric circular spaces whose centre is at B.

30	56	39	49	37
47	32	54	34	52
55	33	53	35	44
38	50	36	59	29
17	69	19	60	26
64	22	66	20	75
72	23	65	21	67
25	63	16	70	18
12	12	12	12	12

5. In the five eccentric circular spaces whose centre is at C.

46	40	55	33	53
31	48	38	50	36
71	17	69	19	60
22	66	20	75	13
65	21	67	12	74
16	70	18	68	27
56	39	49	37	51
41	47	32	54	34
12	12	12	12	12

6. In the five eccentric circular spaces whose centre is at D.

62	24	71	17	69
15	64	22	66	20
23	65	21	67	12
70	18	68	27	61
49	37	51	28	58
32	54	34	52	43
40	55	33	53	35
57	31	48	38	50
12	12	12	12	12

If, now, we take any four numbers, as in a square form, either from N° 1. N° 2. (as we suppose from N° 1.) as in the margin, and add half the central number 12 to them,

14 72
25 63
6

the

Magic
Lantern.
||
Magiabe-
chi.

the sum will be 180; equal to half the numbers in any circular space taken above or below the double horizontal line, and equal to the number of degrees in a semicircle. Thus, 14, 72, 25, 63, and 6, make 180.

Magic Lantern. See DIOPTRICS, art. x, p. 37.

MAGICIAN, one who practices magic, or hath the power of doing wonderful feats by the agency of spirits.

Among the eastern nations it seems to have been formerly common for the princes to have magicians about their court to confer with upon extraordinary occasions. And concerning these there hath been much dispute: some supposing that their power was only feigned, and that they were no other than impostors who imposed on the credulity of their sovereigns; while others have thought that they really had some unknown connection or correspondence with evil spirits, and could by their means accomplish what otherwise would have been impossible for men. See the article **MAGIC**.

MAGINDANAO, or **MINNANAO**. See **MINNANAO**.

MAGISTRY, in chemistry, a name given to almost all precipitates. Thus, *magistry* and *precipitate* are synonymous: but chemists chiefly use *precipitates* as a general term, and apply that of *magistry* to some particular precipitates only which are used in medicine and in the arts. Such are, the magisteries of bismuth, coal, crabs-eyes, sulphur, &c.

Magistry of Bismuth. See **CHEMISTRY**, n^o 766.

MAGISTRATE, any public officer to whom the executive power of the law is committed either wholly or in part.

MAGLIABECCHI (Antony), a person of great learning, and remarkable for an amazing memory, was born at Florence in 1633. His father died when he was only seven years old. His mother had him taught grammar and drawing, and then put him apprentice to one of the best goldsmiths in Florence. When he was about 16 years old, his passion for learning began to show itself; and he laid out all his money in buying books. Becoming acquainted with Michael Ermini, librarian to the cardinal de Medicis, he soon perfected himself by his assistance in the Latin tongue, and in a little time became master of the Hebrew. His name soon became famous among the learned. A prodigious memory was his distinguishing talent; and he retained not only the sense of what he had read, but frequently all the words, and the very manner of spelling. It is said that a gentleman, to make trial of the force of his memory, lent him a manuscript he was going to print. Some time after it was returned, the gentleman, coming to him with a melancholy countenance, pretended it was lost, and requested Magliabechi to recollect what he remembered of it; upon which he wrote the whole, without missing a word. He generally shut himself up the whole day, and opened his doors in the evening to the men of letters who came to converse with him. His attention was so absorbed by his studies, that he often forgot the most urgent wants of nature. Cosmo III. grand duke of Florence, made him his librarian; but he still continued negligent in his dress, and simple in his manners. An old cloak served him for a morning-gown in the day and for bed-cloaths at night. The duke, however,

N^o 197.

provided for him a commodious apartment in his palace, which he was with difficulty persuaded to take possession of; but which he quitted four months after, and returned to his house. He was remarkable for his extraordinary modesty, his sincerity, and his beneficence, which his friends often experienced in their wants. He was a patron of men of learning; and had the highest pleasure in assisting them with his advice and information, and in furnishing them with books and manuscripts. He had the utmost aversion at any thing that looked like constraint; and therefore the grand duke always dispensed with his personal attendance, and sent him his orders in writing. Though he lived a most sedentary life, he reached the 81st year of his age; and died in the midst of the public applause, after enjoying, during the latter part of his life, such assistance as few have ever procured by their learning. By his will, he left a very fine library to the public, with a fund for its support.

MAGLOIRE (St.), a native of Wales in Great Britain, and confessor to St Sampson and St Mallo. He embraced a monastic life, and went into France, where he was made abbot of Dol, and after that a provincial bishop in Brittany. He afterwards founded a monastery in the island of Jersey, where he died on the 14th of October 575, about the age of 80. His remains were transported to the suburbs of St Jacques, and deposited in a monastery of Benedictines, which was ceded to the fathers of the oratory in 1628. It is now the seminary of St Magloire, celebrated on account of the learned men whom it has produced. This saint cultivated poetry with considerable success: the hymn which is sung at the feast of All Saints was composed by him; *Caelo quos eadem gloria confectat*, &c.

MAGNA ASSISA ELIGENDA, is a writ anciently directed to the sheriff for summoning four lawful knights before the justices of assize, in order to choose 12 knights of the neighbourhood, &c. to pass upon the great assize between such a person plaintiff and such a one defendant.

Magna Charta. See **CHARTA**.

MAGNANIMITY, denotes greatness of mind, particularly in circumstances of trial and adversity.—Mr Stretch † well observes of it, that it is the good sense of pride, and the noblest way of acquiring applause. It renders the soul superior to the trouble, disorder, and emotion which the appearance of great danger might excite; and it is by this quality that heroes maintain their tranquillity, and preserve the free use of their reason in the most surprising and dreadful accidents. It admires the same quality in its enemy; and fame, glory, conquests, desire of opportunities to pardon and oblige their opposers, are what glow in the minds of the brave. Magnanimity and courage are inseparable.

1. The inhabitants of Privernum being subdued and taken prisoners after a revolt, one of them being asked by a Roman senator, who was for putting them all to death, what punishment he and his fellow captives deserved? answered with great intrepidity, “We deserve that punishment which is due to men who are jealous of their liberty, and think themselves worthy of it.” Plautinus perceiving that his answer exasperated some of the senators, endeavoured to prevent

Magloire
||
Magnanimity.

Beauties
of History,
under
the word.

the

Magnanimity.

the ill effects of it, by putting a milder question to the prisoner: "How would you behave (says he) if Rome should pardon you?" "Our conduct (replied the generous captive) depends upon yours. If the peace you grant be an honourable one, you may depend on a constant fidelity on our parts: if the terms of it be hard and dishonourable, lay no stress on our adherence to you." Some of the judges construed these words as menaces; but the wiser part finding in them a great deal of magnanimity, cried out, that a nation whose only desire was liberty, and their only fear that of losing it, was worthy to become Roman. Accordingly, a decree passed in favour of the prisoners, and Privernum was declared a municipium. Thus the bold sincerity of one man saved his country, and gained it the privilege of being incorporated into the Roman state.

2. Subrius Flavius, the Roman tribune, being impeached for having conspired against the life of the emperor Nero, not only owned the charge, but gloried in it. Upon the emperor's asking him what provocation he had given him to plot his death? "Because I abhorred thee (said Flavius), though there was not in the whole army one more zealously attached to thee than I, so long as thou didst merit affection; but I began to hate thee when thou becamest the murderer of thy mother, the murderer of thy brother and wife, a charioteer, a comedian, an incendiary, and a tyrant." Tacitus tells us, that the whole conspiracy afforded nothing which proved so bitter and pungent to Nero as this reproach. He ordered Flavius to be immediately put to death, which he suffered with amazing intrepidity. When the executioner desired him to stretch out his neck valiantly, "I wish (replied he) thou mayest strike as valiantly."

3. When the Scythian ambassadors waited on Alexander the Great, they gazed attentively upon him for a long time without speaking a word, being very probably surprised, as they formed a judgment of men from their air and stature, to find that his did not answer the high idea they entertained of him from his fame. At last, the oldest of the ambassadors (according to Q. Curtius) addressed him thus: "Had the gods given thee a body proportionable to thy ambition, the whole universe would have been too little for thee. With one hand thou wouldst touch the east, and with the other the west; and not satisfied with this, thou wouldst follow the sun, and know where he hides himself. But what have we to do with thee? We never set foot in thy country. May not those who inhabit woods be allowed to live, without knowing who thou art, and whence thou comest? We will neither command over, nor submit to, any man. And that thou mayest be sensible what kind of people the Scythians are, know, that we received from heaven as a rich present, a yoke of oxen, a ploughshare, a dart, a javelin, and a cup. These we make use of, both with our friends and against our enemies. To our friends we give corn, which we procure by the labour of our oxen; with them we offer wine to the gods in our cup; and with regard to our enemies, we combat them at a distance with our arrows, and near at hand with our javelins. But thou, who boastest thy coming to extirpate robbers, thou thyself art the greatest robber

Vol. X. Part II.

upon earth. Thou hast plundered all nations thou overcamest; thou hast possessed thyself of Lydia, invaded Syria, Persia, and Bactriana; and thou comest hither to seize upon our herds of cattle. The great possessions thou hast, only make thee covet more eagerly what thou hast not. If thou art a god, thou oughtest to do good to mortals, and not deprive them of their possessions. If thou art a mere man, reflect always on what thou art. They whom thou shalt not molest will be thy true friends, the strongest friendships being contracted between equals; and they are esteemed equals who have not tried their strength against each other: but do not imagine that those whom thou conquerest can love thee."

4. Richard I. king of England, having invested the castle of Chalus, was shot in the shoulder with an arrow; an unskilful surgeon endeavouring to extract the weapon, mangled the flesh in such a manner, that a gangrene ensued. The castle being taken, and perceiving he should not live, he ordered Bertram de Gourdon, who had shot the arrow, to be brought into his presence. Bertram being come, "What harm (said the king) did ever I do thee, that thou shouldst kill me?" The other replied with great magnanimity and courage, "You killed with your own hand my father and two of my brothers, and you likewise designed to have killed me. You may now satiate your revenge. I should cheerfully suffer all the torments that can be inflicted, were I sure of having delivered the world of a tyrant who filled it with blood and carnage." This bold and spirited answer struck Richard with remorse. He ordered the prisoner to be presented with one hundred shillings, and set at liberty; but Maccardee, one of the king's friends, like a true Russian, ordered him to be slayed alive.

5. The following modern instance is extracted from a late French work intitled, *Ecole historique & morale du soldat*, &c. A mine, underneath one of the outworks of a citadel, was intrusted to the charge of a serjeant and a few soldiers of the Piedmontese guards. Several companies of the enemy's troops had made themselves masters of this work; and the loss of the place would probably soon have followed had they maintained their post in it. The mine was charged, and a single spark would blow them all into the air. The serjeant, with the greatest coolness, ordered the soldiers to retire, desiring them to request the king to take care of his wife and children; struck fire, set a match to the train, and sacrificed himself for his country.

MAGNESA, or MAGNESIA, (anc. geog.) a town or a district of Thessaly, at the foot of mount Pelius, called by Philip, the son of Demetrius, one of the three keys of Greece, (Pausanias.)

MAGNESIA, or MAGNESIA ALBA, in mineralogy and chemistry, A kind of earth only discovered since the beginning of this century. It first began to be known at Rome by the name of the *Count de Palma's powder*, which a canon there offered as a general remedy for all disorders. It was by many considered as a calcareous earth; but F. Hoffman showed it to be essentially distinct. The same was afterwards done by

Magnanimity
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Magnesia.Raphin's Hist
an. 1799

Dr Black of Edinburgh and M. Margraaf of Berlin, though unknown to each other at the time. When pure, it is extremely white, loofe, and light; the ſpecific gravity about 2.330. It is one of the moſt infuſible ſubſtances in nature; neither melting, nor even hardening nor contracting, in the focus of the moſt powerful burning-glaſs. An experiment was made on ſome of this earth in the ſummer of 1782 by M. Magellan, with Mr Parker's burning-glaſs; the effects of which are more powerful than thoſe of any other, though its diameter is only 32 inches. The event ſeemed at firſt to be unfavourable to the concluſion above mentioned; for a cubic inch of magnesia, a quarter of an inch each ſide, being put into its focus, was hardened, and reduced to leſs than a third part of its bulk each way, viz. from .25 of an inch to .08. On applying a ſimilar cube of magnesia, however, from Mr Henry's manufacture at Manchester, it neither became harder nor ſenſibly diſmiiniſhed in ſize. Bergman informs us, that magnesia, unleſs precipitated by the volatile alkali, or that by the neat alkaliſed tartar, always contains ſome ſiliceous or calcareous earth. Almoſt the ſame thing happens when it is ſeparated by calcination from the remaining lixiviations of the nitrous and marine acids; in which caſe, by ſuch a violent fire, it adheres together, and even ſhows a tendency to vitrify.

Notwithſtanding this extreme refractorineſs of magnesia by itſelf, it melts eaſily with borax, though ſcarce affected by alkalis or the calces of lead; when mixed with other earths it produces hard maſſes of various kinds; when mixed with calcareous, argillaceous, or ſiliceous earths, it melts in the fire; and if four times its weight of green glaſs be added to it, the maſs forms a kind of porcelain ſo hard as to ſtrike fire with ſteel. But neither an equal part of the above earths, nor of ponderous earth, glaſs of lead, vegetable alkali, nor vitriolated tartar, added ſeparately to magnesia, will melt in the fire: however, when mixed with common argillaceous earth, it melts into a hard maſs. Magnesia differs from calcareous earth in having a much ſmaller attraction for fixed air. In this reſpect it is inferior even to fixed alkaline ſalts; ſo that it will not render any of theſe cauſtic, though it will do ſo to the volatile alkali. It alſo parts very readily with its own fixed air by mere heat; and it was by making experiments on this ſubſtance that Dr Black made his firſt diſcoveries concerning fixed air. In its calcined ſtate, however, it does not ſhow any of the cauſticity of lime, but may be ſafely taken internally; and is even preferred by ſome to that which contains fixed air. In this ſtate it is much leſs ſoluble than when combined with fixed air, and does not efferveſce with any acid. When mixed with water, a very ſmall degree of heat is excited, and in about 7962 times its weight of water it totally diſſolves. It diſſolves alſo very readily in aerial acid; by which means it is frequently united with freſh water. For the ſame reaſon, when we mix a ſolution of perfect mild alkali, either fixed or volatile, with a ſolution of magnesia, no precipitation follows; becauſe the great quantity of fixed air extricated by the union of the acid and alkali, inſtantly diſſolves the precipitate as faſt as it is formed. But if we put this mixture over the fire, it will grow thick, and coagulate as ſoon as it is heated to a cer-

tain degree; becauſe the magnesia is unable to retain, Magnesia, in any conſiderable heat, as much fixed air as is neceſſary for its ſolution.

On putting magnesia into water, and afterwards drying it, it is found to retain $\frac{1}{10}$ of its weight of aqueous fluid; but when fully ſaturated with aerial acid, it will abſorb and retain $\frac{1}{10}$ of the ſame. When fully ſaturated with aerial acid, it is more ſoluble in cold than in hot water; becauſe the heat of the latter diſſipates part of the fixed air, as was obſerved concerning the alkaline ſalts.

Magnesia, when combined with different acids, forms ſalts exceedingly different from thoſe produced by calcareous earth under ſimilar circumſtances; and of which an account is given under the article CRYMISTRY. It is uſually prepared either from the bitter of ſea-ſalt, or from the ſalt prepared from that liquid under the name of Epſom ſalt. The magnesia prepared directly from the bitter, however, is by no means equal in purity to that produced from the finer kinds of Epſom ſalt. Hence, in order to have pure magnesia, Bergman gives the following directions: "Let Epſom ſalt, in well-formed cryſtals, be diſſolved in diſtilled water; and from this the magnesia is to be precipitated by mild volatile alkali. Some of this earth that remains ſuſpended in the ſolution, by means of aerial acid, may be eaſily precipitated by a ſimple ebullition. An hundred pounds of this magnesia, when rightly prepared, contains near 25 parts of fixed air, 30 of water, and 45 of pure earth. Its ſpecific gravity is then 2.155. This method of preparation may anſwer very well for having a very pure magnesia; but when it is required to have it very light and ſpongy, which, by thoſe who uſe it, is looked upon to be the only criterion of its goodneſs, we muſt uſe the following method:

Take any quantity of Epſom ſalt, diſſolve it in boiling water, and filter the ſolution. Diſſolve alſo half the quantity of good pearl-aſh, and filter this ſolution. Both of theſe ſolutions ought to be ſomewhat diluted; and it will be proper to uſe twice the quantity of water which would fairly diſſolve the ſalts. Mix the two ſolutions when nearly cold, and ſtir them very well together. Let the mixture ſtand for ſome hours until the precipitate, has fallen to the bottom in form of a coarſe gritty powder. Put the whole then into a clean copper kettle, under which a moderate fire is made. Stir the matter inceſſantly with a large wooden ſpatula, to prevent the powder from ſticking to the bottom. As the mixture heats, the powder begins to loſe its ſandy appearance, and to increaſe greatly in quantity; ſo that, though at firſt the mixture was quite thin, with only a ſmall portion of ſandy matter amongſt it, before it has attained the boiling heat it will be ſo thick that it can ſcarce be ſtirred. When the grittyneſs is quite gone, the matter muſt be put upon a filtering cloth, and warm water poured upon it till it runs ſinſpid. The magnesia is then to be put upon chalk ſtones, which will abſorb the greateſt part of the moiſture; and it may at laſt be fully dried in a ſtove.

Magnesia alba is a good abſorbent; and undoubtedly to be preferred to crab's-eyes, on account of its purgative quality when united with an acid, which the other has not. It has been eſteemed hurtful in bi-

lions habits where there is a disposition in the stomach contrary to acidity. This, however, according to Mr Henry, is doubtful: and where putrid bile is to be corrected, he thinks good purposes may be answered by taking magnesia with an acid in a state of effervescence; as the fixed air, thus extricated, will correct the putridity of the contents of the intestines, while they are at the same time evacuated downwards. He is also of opinion, that in cutaneous diseases it may enter the circulation in form of a neutral salt, and, by acting as a diaphoretic and diuretic, prove an excellent alterative.

For some medical purposes, magnesia is used in a calcined state; in which case it is deprived of its fixed air, and then it proves nearly as aperient as a double quantity of magnesia in its uncalcined state. Mr Henry is of opinion, that it may be useful in distensions of the bowels arising from flatulency; that it may be successfully employed as a cathartic with patients labouring under the stone, who are using the *lixivium saponaceum*; and that, joined with warm aromatics, it may be of service in correcting the great flatulency which so much afflicts people of a gouty disposition. From several experiments made by the same author, it also appears that magnesia has a considerable antiseptic power. The like virtue he ascribes to all kinds of testaceous powders: whence he concludes, that medicines of this kind are by no means improper in fevers of a putrescent type; that where bile is suspected to be the cause of any putrid disease, those antiseptics should be prescribed which particularly impede its corruption; that, as calcined magnesia is a more powerful antiseptic than most other absorbents, it merits a preference to these; and that where an acid cacochymy prevails, magnesia or other absorbents, taken immediately before or after meal-time, may, by increasing the putrefactive fermentation of animal-food, be of very great service. He hath also found, that magnesia hath a power of promoting the solution of resinous gums in water; and thus we have an elegant and easy method of preparing aqueous tinctures from these substances. Such tinctures, however, are calculated only for extemporaneous prescription, as most of them deposit a sediment when they have been kept a week or two.

Black MAGNESIA. See MANGANESE.

MAGNESIA (anc. geog.), a maritime district of Thessaly, lying between the fourth part of the Sinus Thermaicus and the Pegasus to the south, and to the east of the Pelagiotis. *Magnetes*, the people. *Magnesium* and *Magnesium*, the epithet; (Horace).

MAGNESIA, a town of Asia Minor on the Mæander, about 15 miles from Ephesus. Themistocles died there: it was one of the three towns given him by Artaxerxes, with these words, "to furnish his table with bread." It is also celebrated for a battle which was fought there, 190 years before the Christian æra, between the Romans and Antiochus king of Syria. The forces of Antiochus amounted to 70,000 men according to Appian, or 70,000 foot and 12,000 horse according to Livy, which has been exaggerated by Florin to 300,000 men; the Roman army consisted of about 28 or 30,000 men, 2000 of which were employed in guarding the camp. The Syrians lost 50,000 foot and 4000 horse; and the Romans only

300 killed, with 25 horse. It was founded by a colony from Magnesia in Thessaly; and was commonly called *Magnesia ad Mæandrum*, to distinguish it from another, called *Magnesia ad Sipylum* in Lydia at the foot of mount Sipylus.

MAGNESIA ad Sipylum, anciently *Tantalus*, the residence of Tantalus, and capital of Mæonia, where now stands the lake Sale. A town of Lydia, at the foot of mount Sipylus, to the east of the Hermus; adjudged free under the Romans. It was destroyed by an earthquake in the reign of Tiberius.

MAGNET (*Magnet*), the **LOADSTONE**: a sort of ferruginous stone, in weight and colour resembling iron ore, though somewhat harder and more heavy; endowed with various extraordinary properties, attractive, directive, inclinatory, &c. See **MAGNETISM**.

The magnet is also called *Lapis Herculeus*, from Heraclea, a city of Magnesia, a port of the ancient Lydia, where it is said to have been first found, and from which it is usually supposed to have taken its name. Though others derive the word from a shepherd named *Magnet*, who first discovered it with the iron of his crook on mount Ida. It is also called *Lapis Nauticus*, by reason of its use in navigation; and *siderites*, from its attracting iron, which the Greeks call *σίδερος*.

The magnet is usually found in iron mines, and sometimes in very large pieces half magnet half iron. Its colour is different according to the different countries it is brought from. Norman observes, that the best are those brought from China and Bengal, which are of an iron or sanguine colour; those of Arabia are reddish; those of Macedonia blackish; and those of Hungary, Germany, England, &c. the colour of unwrought iron. Neither its figure nor bulk is determinate, it is found of all forms and sizes.

The ancients reckoned five kinds of magnets, different in colour and virtue: the Ethiopic, Magnesian, Boeotic, Alexandrian, and Natolian. They also took it to be male and female: but the chief use they made of it was in medicine; especially for the cure of burns and defluxions on the eyes.—The moderns, more happily, employ it to conduct them in their voyages. See **NAVIGATION**.

The most distinguishing properties of the magnet are, That it attracts iron, and that it points to the poles of the world; and in other circumstances also dips or inclines to a point beneath the horizon, directly under the pole; and that it communicates these properties, by touch, to iron. On which foundation are built the mariner's needles, both horizontal and inclinatory.

Attractive Power of the MAGNET was known to the ancients; and is mentioned even by Plato and Euripides, who call it the *Herculean stone*, because it commands iron, which subdues every thing else: but the knowledge of its directive power, whereby it disposes its poles along the meridian of every place, and occasions needles, pieces of iron, &c. touched with it, to point nearly north and south, is of a much later date; though the exact time of its discovery, and the discoverer himself, are yet in the dark. The first tidings we hear of it is in 1269, when Marco Polo the Venetian is said by some to have introduced the mariner's compass; tho' not as an invention of his own, but as deriv-

Magnet.

ved from the Chinese, who are said to have had the use of it long before; though some imagine that the Chinese rather borrowed it from the Europeans.

Flavio de Gioia, a Neapolitan, who lived in the 13th century, is the person usually supposed to have the best title to the discovery: and yet Sir G. Wheeler mentions, that he had seen a book of astronomy much older, which supposed the use of the needle; though not as applied to the uses of navigation, but of astronomy. And in Guyot de Provins, an old French poet, who wrote about the year 1180, there is an express mention made of the loadstone and the com-

pass; and their use in navigation obliquely hinted at.

The Variation of the Magnet, or its declination from the pole, was first discovered by Seb. Cabot, a Venetian, in 1500; and the variation of that variation, by Mr Gellibrand, an Englishman, about the year 1625. See *VARIATION*.

Lastly, the dip or inclination of the needle, when at liberty to play vertically, to a point beneath the horizon, was first discovered by another of our countrymen, Mr R. Norman, about the year 1576. See the article *Dipping-Needle*.

MAGNETICAL NEEDLE. See *Magnetical NEEDLES*.

Magnet.

M A G N E T I S M;

THE power by which the loadstone is influenced, manifesting itself by certain attractive and directive virtues, and which may be understood from the following phenomena afterwards mentioned, which are common to all magnetical bodies.

CHAP. I. Phenomena and Laws of Magnetism.

§ 1. Phenomena of the Magnet.

1. A magnet, whether natural or artificial, attracts iron, and all substances which contain it in its metallic state. A pure calx of iron is but little attracted; but if the calx be heated strongly in conjunction with charcoal dust, it will then be attracted, though it has not regained its metallic splendour, and is quite destitute of malleability. The femimetal called *nickel*, and perhaps some others, are attracted by the magnet, though freed from iron as much as possible. From some accounts it has been suspected that brass was in a small degree affected by the magnet, and even that all very minute bodies are somewhat under its influence; but this seems not yet to be sufficiently ascertained.

2. If a magnet be suspended by a thread, nicely placed on a pivot, or set to float in a basin of water, it will turn one and constantly the same side nearly towards the north pole of the earth, the other of course turning towards the south. Hence these parts of the magnet have been called its poles, taking the designations of north and south from those parts of the world towards which they turn. This property is called the *polarity* of the magnet; and when it is in the act of turning itself into this position, it is said to *traverse*. A plane drawn perpendicular to the horizon through both poles of a magnet, after it has turned itself, is called the *magnetic meridian*; and the angle it makes with the meridian of the place is called the *declination* of the magnet or of the magnetic needle.

3. When either the north or the south poles of two magnets are placed near to each other, they repel; but a north and a south pole attract each other.

4. A magnet placed in such a manner as to be entirely at liberty, inclines one of its poles to the horizon, and of course elevates the other above it. This property is called the *inclination* or *dipping* of the magnet; and is most conspicuous in artificial magnets or needles, which may be accurately balanced before the magnetic virtue is imparted to them.

5. By proper management any magnet may be

made to communicate its virtue to a piece of steel or iron, which virtue it will retain for a longer or shorter time according to circumstances.

§ 2. Of the different Substances attracted by the Magnet.

It has already been said, that iron is the only substance which the magnet particularly attracts, and that too when in its metallic state. Nevertheless this metal is so universally diffused, that there are few substances which do not contain a sufficient quantity of it to be in some degree affected by the magnet. Iron itself is attracted with different degrees of force according to the state in which it is with regard to malleability.— Even the purest calx or solution that can be made, is said to be in some degree affected by the magnet; but of all substances soft iron is attracted with the greatest force when clean and of an uniform texture. Hardened steel is attracted with much less force than iron; but the scales separated from red-hot iron, the fused globules from flint and steel, or the finery cinder, are attracted as much as iron itself. The black calx of iron is attracted but very weakly; and the red calx or rust so little, that it is generally said to be quite insensible to the magnetic attraction; though this is not found to be strictly true, even when the calx is prepared by fire, and purified in the most careful manner. Sometimes the scales and calx are capable of acquiring a polarity, though weakly. Ores of iron are attracted with greater or less force according to the state of the metal in them, and according to the quantity of it they contain; though the attraction is always manifest even when they contain such a small quantity as scarcely to deserve the name of ores. They are generally much more attracted after calcination than before; because this operation communicates to them a portion of phlogiston by which they approach to a metallic state. Ores of lead, tin, and copper, are likewise attracted, as well as native cinnabar, on account of the quantity of iron they contain; and it is remarkable, that though pure lead in its metallic state is not in the least attracted, its calx is so in some degree. The calx of tin is also attracted, though in a still smaller degree than that of lead. Zinc, bismuth, and cobalt, but especially the ores of these femimetals, are attracted; but not antimony, unless it be first exposed to a gentle heat; and arsenic is not attracted at all. One kind of bismuth is said to be absolutely repelled by the magnet. Almost all other minerals are attracted, at least after having been exposed to the ac-

tion of fire. Calcareous earth is attracted less than any other kind, and the siliceous earth the most frequently. Sand, especially the black kind, is generally attracted; and amber as well as other combustible substances have the same property, after being burned. Almost every part of animal and vegetable bodies is affected by the magnet after being burned; but unburned animal or vegetable substances are very seldom if ever perceptibly attracted. It is also remarkable, that even foot, or the dill which falls upon any thing left exposed to the atmosphere, are sensibly attracted. Colourless precious stones, as the diamond and crystals, are not attracted; neither the amethyst, topaz, chalcidony, or such as are deprived of their colour by fire; but all others, as the ruby, chrysolite, and tourmalin, are attracted. The emerald, and particularly the garnet, are not only attracted, but frequently acquire an evident polarity. The opal is attracted but weakly.

The attraction of so many different substances shows the universal diffusion of iron throughout almost all terrestrial substances; for to this we are with the greatest probability to ascribe the attraction of so many substances by the magnet. How small a quantity of iron indeed will give a substance this property, is evident from the following experiment related by Mr Cavallo. "Having chosen a piece of Turkey-stone which weighed above an ounce, I examined it by a very sensible magnet needle, but did not find that it was affected in the least. A piece of steel was then weighed with a pair of scales, which would turn with the 20th part of a grain, and one end of it drawn over the stone in various directions. After this operation the steel was again weighed, and found to have lost no perceptible part of its weight; yet the Turkey-stone, which had acquired only this very small quantity of steel, now affected the magnetic needle very sensibly." In making his observations on this experiment, he proposes the magnet as a test of iron in different substances, being capable of detecting a smaller quantity than any method that chemistry can yet afford.

Our author has been at considerable pains to investigate the magnetic properties of brads and other metals; having made many experiments upon the subject, of which the following are the results: 1. Hammered brads is much more generally attracted by the magnet than other kinds; and such as is not influenced in this manner, acquires the property by being hammered. 2. A piece of brads rendered magnetic by hammering, loses the property on being made red hot so as to become softened; by a second hammering it becomes again magnetic; and thus may be made to lose its property and recover it alternately. 3. Supposing that the magnetic property might be occasioned by a small quantity of iron abraded from the hammer, the pieces of brads were beat between two pieces of card-paper; notwithstanding which precaution, it acquired the magnetic property as before. 4. Sometimes an evident degree of magnetism was communi-

cated by two or three strokes, and with the card-paper not above 30 strokes were given to make the brads sensibly magnetic. 5. A piece of brads was hardened by beating it between two large flints, using one for the hammer and the other for the anvil; but still it acquired a magnetic property, tho' less than with the iron hammer, which might be explained by the roughness of the flints, and their not coming into contact sufficiently with the metal. Neither of the flints was found to have acquired the smallest degree of magnetic power either before or after the experiment. 6. By melting the brads in a crucible, it was found to have entirely lost its magnetism. 7. A piece of brads deprived of its magnetic property by fire, regained it after a few strokes of the hammer, though laid between two pieces of copper. 8. Most of the pieces of brads tried by our author became magnetic by hammering; but some, though rendered equally hard with the rest, did not affect the needle in the least; but these could not originally be distinguished from such as are capable of becoming magnetic. 9. As, notwithstanding the precautions made use of in the above experiments to prevent the iron of the hammer from being in any manner of way communicated to the brads, an objection might arise, that some quantity of the calx might be diffused through the metal, and acquire phlogiston by hammering, he tried the following experiment, which seemed decisive. A piece of brads which would acquire no magnetism by hammering, was put upon an anvil with a considerable quantity of crocus martis, which had no effect upon the needle. It was then hammered for a long time, turning it frequently, so that the crocus was beat into the substance of the brads, and gave it a red colour; nevertheless, it affected the needle in this state no more than before. 10. A hole of about an eighth part of an inch in length, and little more than one 50th of an inch in diameter, was drilled in a piece of brads which could not be rendered magnetic by hammering; after which the hole was filled with crocus martis, and hammered as before, but still it showed no signs of magnetism (A). 11. On making this piece of brads, containing the crocus, red hot, it then affected the needle, but only in that place where the crocus was. 12. On repeating this experiment with black calx of iron instead of crocus martis, the brads was weakly attracted in that place where the calx was, and this attraction was neither augmented nor diminished by calcination. 13. On mixing a small quantity of iron with four times its weight of brads which could not be made magnetic by hammering, the whole was rendered powerfully magnetic; but on again mixing this compound with 50 times its weight of the same brads, the attraction became so weak as to be scarcely perceptible; and was neither augmented by hammering nor diminished by softening. 14. On repeating most of his experiments, by letting the pieces of brads float upon quicksilver in the manner hereafter described, he found that very few of them were not affected; and even the indifference of any of them did not seem to be

(A) These two experiments seem inconsistent with our author's assertion, that calces of iron are always affected in some degree by the magnet.

Sulphates
attracted
by the
Magnet.

be very well ascertained; though these did not acquire any additional magnetism by hammering.

From all these experiments Mr Cavallo draws the following conclusions. 1. Most brads become magnetic by hammering, and loses that property by annealing or softening in the fire; or at least its magnetism is so far weakened by it, as afterwards to be only discovered when floated on quicksilver. 2. The acquired magnetism is not owing to particles of iron naturally or artificially mixed with the brads. 3. The pieces of brads which have that property retain it without any diminution after a great number of repeated trials; but he found no method of giving magnetism to brads which had it not naturally. 4. A large piece of brads has generally a stronger magnetic power than a small one; and the flat surface draws the needle more powerfully than the edge or corner. 5. If only one end of a piece of brads be hammered, then that end alone will disturb the magnetic needle. 6. The magnetic power which brads acquire by hammering has a certain limit, beyond which it cannot be increased by farther hammering. This limit is different in different pieces of brads, according to their thickness or quality. 7. In the course of his experiments, the following circumstance was twice observed: A piece of brads which had the property of becoming magnetic by hammering, and of losing that property by annealing, lost its magnetic power entirely by being left in the fire till partially melted, but recovered it again on being fully so. 8. A long continuance in a strong fire, which alters the texture of the metal, making it what some workmen call *rotten*, generally destroys the magnetic property also; whence this property seems to be owing to some particular configuration of its parts. 9. When brads is used in magnetical instruments, it ought either to be left entirely soft, or chosen of such a sort as will not become magnetic by hammering. 10. There are few substances in nature, which, when floated upon quicksilver, are not affected in some degree by the magnet.

Our author next proceeded to try the magnetic power of other metals, particularly the component parts of brads, &c. copper, and zinc. With the former the result was doubtful; and though pieces of hammered copper would sometimes attract the needle, yet the attraction was always exceedingly weak. Zinc had no effect, either in its natural state or hammered as much as it could bear without breaking. A mixture of it with tin had no effect. The same was observed of a piece of a broken reflector of a telescope made of tin and copper; a mixture of tin, zinc, and copper; a piece of silver whether soft or hammered; a piece of pure gold whether soft or hammered; a mixture of gold and silver, both hard and soft; and another mixture of much silver, a little copper, and a still less quantity of gold.

The magnetic property of nickel has been mentioned by several authors; but Mr Cavallo says he has found some pieces which did not affect the needle in the least. "It is probable (says he) that these pieces were not pure nickel, and perhaps some cobalt was contained in them; but I see no reason why the nickel, when alloyed with a little cobalt, should show no attraction towards the magnet, if that property did

really and essentially belong to it." Our author, lastly, made several experiments upon platina; the magnetic properties of which were found to be very similar to those of brads; the native grains becoming magnetic by hammering, and losing that property by heat; but the precipitate from aqua-regia, fused in a violent fire, or rather concentered together by this means, showed no sign of attraction whatever.

§ 3. *Of the Attraction of the Magnet towards Iron in its various States of Existence.*

I. The first experiment which naturally occurs on this subject is, Whether mere heat can make any change in the magnetic properties of iron without destroying its texture or diminishing the power of the magnet to which it is applied. Kircher says, that he tried this experiment, and found that a piece of iron heated to such a degree as to be scarcely discernible from a burning coal, was in that state as powerfully attracted as if it had been cold. Mr Cavallo found the effect directly the reverse; for, having heated a piece of steel red hot, and in that state presented it to the magnet, so as to touch it repeatedly in various places, not the least sign of attraction could be perceived. In this experiment, the redness of the iron could plainly be perceived in day-light; and our author acknowledges, that iron, tho' its redness be perceptible in the dark, will still be attracted by the magnet. The result was the same on repeating the experiment a number of times over; but the attraction became as strong as ever a little after the redness ceased in the dark. The attraction seemed to begin sooner in steel than in iron. Our author does not pretend to say, that by heating iron to a red, or even to a white heat, the attraction of the magnet for it is absolutely annihilated; but it certainly was so far diminished that it did not affect the magnetic needle.

II. It was now tried what would be the effect of decomposing iron; and with this view an earthen vessel, containing about two ounces of iron-filings, was placed near the fourth end of the needle of the compass, by which the latter was drawn a little out of its direction. On adding some water, and then vitriolic acid, the attraction seemed to be increased, and the needle came nearer the vessel. This superior attraction continued till the effervescence began to cease; and at last it was found to be inferior to what it had been originally. To obviate some objections which might arise from the motion of the iron-filings, the experiment was repeated with steel-wire twisted in various directions, so as to present a large surface to the acid and being placed at a proper distance from the needle, it attracted it out of its direction from 281° to 280° . After adding the diluted vitriolic acid, a strong effervescence ensued, and the needle was moved to $279^{\circ} 47'$; five minutes after that it stood at $279^{\circ} 35'$; and in five minutes more at $279^{\circ} 33'$; seeming even to come somewhat nearer in a little time after: but as it then appeared to have gained its maximum of attraction, the pot was removed, and the needle went back to its original situation of 281° .

On repeating this experiment with different acids, it was found that the vitriolic increased the attraction more than either the nitrous or marine. With the former of these the maximum of attraction was sooner gained

Attraction
towards
Iron.

Degrees,
&c. of
Attraction

gained and sooner lost than with the rest; and with marine acid the attraction was weakest of all; which, however, our author imputes to his not being able to raise a sufficient effervescence with this acid.

III. The degree of magnetic attraction depends upon the strength of the magnet itself, the weight and shape of the iron presented to it, the magnetic or unmagnetic state of the body, and the distance between them. A piece of clean and soft iron is more powerfully attracted than any other ferruginous substance of the same size and shape. Steel is attracted less powerfully. The attraction is strongest at the poles, diminishing according to the distance from them, and entirely ceasing at the equator or middle point betwixt the poles. It is strongest near the surface of the magnet, diminishing as we recede from it; but the proportion in which this diminution takes place has not been exactly determined. M. Muschenbroeck made the following experiments in order to determine this point.

1. A cylindrical magnet, two inches long, and weighing 16 drams, was suspended by an accurate balance above a cylinder of iron exactly of the same shape and dimensions, and the degree of attraction betwixt the two measured by weights put into the opposite scale; the magnet being successively placed at different distances from the iron. The results were as follow:

Distance in inches.	Attraction in grains.
6	3
5	3½
4	4½
3	6
2	9
1	18
0	57

2. A spherical magnet of the same diameter with the cylindrical one, but of greater strength, was affixed to one of the scales of the balance, and the cylindrical magnet used in the former experiment placed upon the table with its south pole upwards, facing the north pole of the spherical magnet; when the attractions were found as follow:

Distance in inches.	Attraction in grains.
6	21
5	27
4	34
3	44
2	64
1	100
0	260

3. Changing the cylindrical magnet for the iron cylinder abovementioned, the result was as follows:

Distance in inches.	Attraction in grains.
6	7
5	9½
4	15
3	25
2	45
1	92
0	340

IV. Using a globe of iron of the same diameter with the magnet instead of the cylinder, the results were:

Distance in inches	Attraction in grains.
8	1
7	2
6	3½
5	6
4	9
3	16
2	30
1	64
0	290

In the experiments with the cylinder, it was found that the magnet attracted a shorter cylinder with less force, but in the same proportion.—From the others, it appears, that one magnet attracts another with less force than a piece of iron, but that the attraction begins from a greater distance; whence it must follow a different law of decrease.

IV. The attraction between the magnet and a piece of iron is subject to variation from the mere shape of the latter, there being a limit in the weight and shape of the iron, in which it will attract it more forcibly than any other; but this can only be determined by actual experiment.

V. It has already been observed, that magnetic attraction takes place only between the opposite poles of two magnets: however, it frequently happens, that though the north pole of one magnet be presented to the north pole of another, that they show neither attraction nor repulsion; but that when placed very near each other, they will attract. This is explained by our author in the following manner: "When a piece of iron, or any other substance that contains iron, is brought within a certain distance of a magnet, it becomes itself a magnet, having the poles, the attractive power, and, in short, every property of a real magnet. That part of it which is nearest to the magnet acquires a contrary polarity; but it often happens that one of the magnets, being more powerful than the other, will change the pole of that other magnet in the same manner as it gives magnetism to any other piece of iron which is exposed to its influence; and then an attraction will take place between two poles apparently of the same names; though, in fact, it is an attraction between poles of different names, because one of them has actually been changed. Thus, suppose that a powerful magnet has been placed with its north pole very near the north pole of a weak magnet, it will be found, that, instead of repelling, they will attract each other, because that part of the weak magnet which before was a north pole, has been changed into a south pole by the action of the strong magnet."

VI. Neither the attraction nor the repulsion of magnetism is sensibly affected by the interposition of bodies of any sort, excepting iron or ferruginous substances in general. Thus suppose, that, when a magnet is placed at an inch distance from a piece of iron, an ounce, or any determinate weight, is required to move it; the same will be required, though a plate of metal,

Degrees,
&c. of
Attraction

Decreased
&c. of
Attraction.

metal, glass, or any other substance excepting iron be interposed. Neither the absence nor presence of air has any effect upon it.

VII. By heat, the power of a magnet is weakened; and when it arrives at that degree called a white heat, it is entirely destroyed. On the other hand, the attraction is increased considerably by adding more and more weight to the magnet: for thus it will be found that the magnet will keep suspended this day a little more weight than it did the day before; which additional weight being added to it on the following day, or some day after, it will be able to suspend a weight still greater, and so on as far as a certain limit. On the other hand, by an improper situation, or by diminishing the quantity of iron appended to it, the power will decrease very considerably.

VIII. The magnetic attraction is communicable to any given piece of steel only in a certain degree; and therefore if a magnet is strong enough to give the maximum of attraction to the piece, it cannot be afterwards rendered more powerful by applying another magnet, however strong. Thus, indeed, the steel may be made stronger for a few minutes; but this overplus of attraction begins to go off as soon as the strong magnet is withdrawn; and the power, continuing gradually to diminish, settles in a short time at that degree which is its limit ever after.

IX. Some have asserted, that in the northern parts of the world, the north pole of the magnet is stronger than the south pole, and that in the southern parts the contrary takes place; others are of a quite contrary opinion, affirming, that in the northern regions the south pole is stronger than the north one: but neither of these opinions have yet been sufficiently confirmed by experience.

X. If a piece of iron be held to one of the poles of a magnet, the attractive power of the other pole will thus be augmented: Hence we may understand why a magnet will lift a greater weight from a piece of iron than from wood or any other substance, viz. that the iron appended to the magnet becomes itself a magnet while it remains in that situation; and thus, having two poles, the iron which is placed near the one increases the attractive power of the other which adheres to the magnet, and enables it to sustain a greater weight than it would otherwise do.

XI. Soft iron acquires the magnetic power by being appended to a magnet; but it lasts only while the iron remains in that situation, vanishing as soon as the magnet and iron are separated from each other. With hard iron, but especially steel, the case is quite different; and the harder the iron or steel is, the more permanent is the magnetism which it acquires; though in proportion to this same hardness it is difficult to impregnate it with the virtue.

XII. The smallest natural magnets generally possess the greatest proportion of attractive power; so that there have frequently been seen magnets not weighing more than 20 or 30 grains, which would take up 40 or 50 times their own weight; but the greatest proportion of attractive power, perhaps ever known, belonged to the magnet worn by Sir Isaac Newton in his ring. It weighed only three grains, and was able to take up 746 grains, or nearly 250 times its own weight; and Mr Cavallo has seen one which could not weigh more

Nº 191.

than six or seven grains, and yet was capable of lifting 300. A semicircular steel magnet made by Mr Canton, weighing one ounce and 13 penny-weights, took up 90 ounces; but magnets of above two pounds seldom lift more than five or six times their own weight, or indeed seldom so much. It frequently happens, that a piece cut off from a large natural magnet will lift more than the stone itself did when whole; which is to be attributed to the heterogeneous nature of the stone itself; for if part of it be impure, it is plain that this can do nothing else than obstruct the virtue of the remainder, which consequently must act more powerfully when the obstruction is removed.

13. As the two magnetic poles taken together are capable of lifting a much greater weight than a single one, and as they are generally situated in opposite parts of its surface, it has been customary to adapt two broad pieces of soft iron to them, letting the pieces project on one side of the magnet; because, in that case, the pieces themselves being rendered magnetic, another piece of iron could be conveniently adapted to their projections so as to let both poles act in concert. These pieces of iron are generally held fast upon the magnet by means of a brass or silver box; in which case the magnet is said to be *armed*, and the pieces of iron are called its *armature*. For the same purpose, and to avoid the armature, artificial magnets have been commonly made in the shape of a horse-shoe, having their poles in the two extremities. This is by far the best shape for magnets; and the horse-shoe ones are always more powerful than straight magnetic bars.

§ 4. Of the Polarity of the Magnet.

Though, properly speaking, no magnet can have more than two poles, viz. a north and a south one, yet it frequently happens that both the natural and artificial kind are divided as it were into several magnets; each of which having likewise a north and south pole, the whole appears to have a number of poles, some of one denomination and some of the other.— This plurality of poles arises sometimes from the shape, but more commonly from the heterogeneous nature, of the magnet itself: and with respect to those which have more than two poles, the following laws have been observed: 1. That the parts adjacent to one pole are endowed with a contrary polarity. 2. That the poles of one denomination are not always equal in number, but that they never differ by more than one: thus if the magnet has four south poles, it will either have three, four, or five north poles. Good and properly shaped magnets, however, have only two poles directly opposite to one another; though in truth it is always one half, or at least a great part of the magnet, that possesses one kind of polarity, the other having the contrary kind; the two points, which we call the *poles*, being only those where the attractive virtue is strongest. Those two points, in good magnets, are joined by a line passing through the centre, which line is called the *axis* of the magnet; and a circle whose plane is perpendicular to the axis encompassing the middle of the magnet is called its *equator*; and to complete the supposed similarity between the terraqueous globe and magnetical bodies, the latter have frequently

Polarity
of the
Magnet.

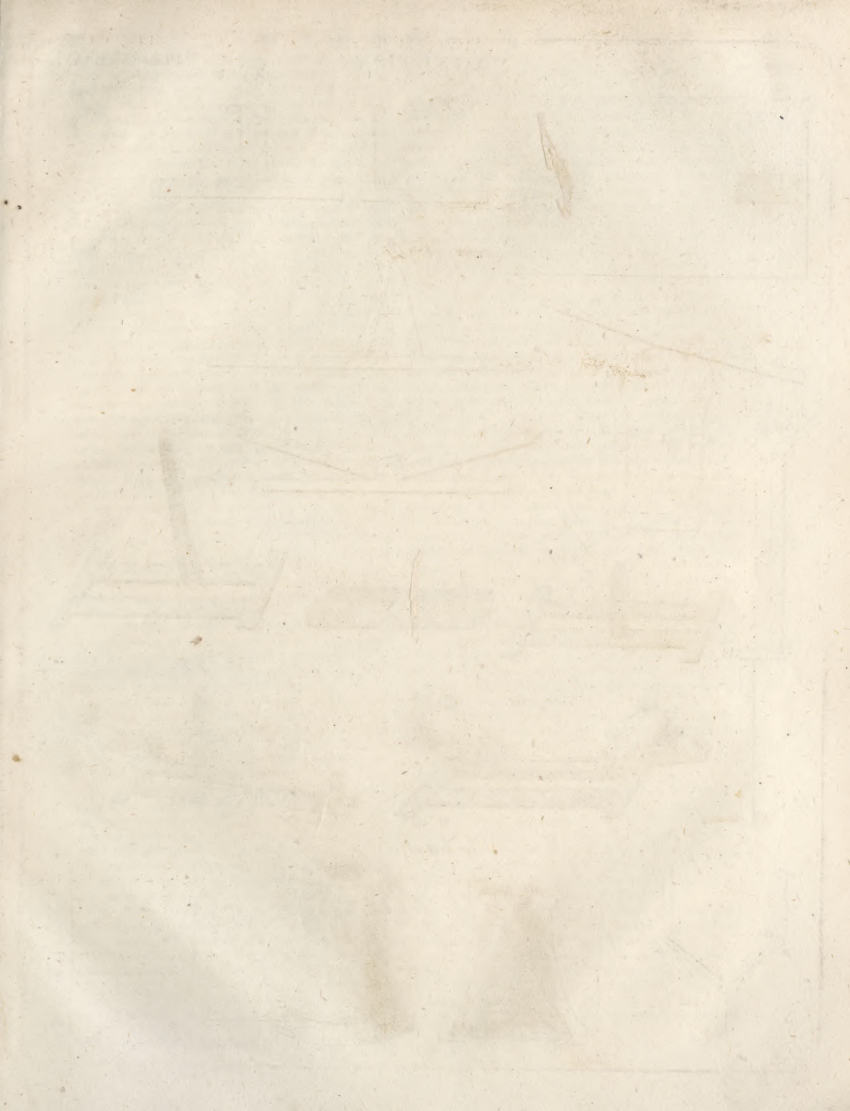


Fig. 1.

MAGNETISM.

Plate CCLXXVI.

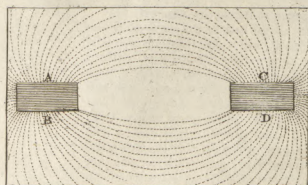


Fig. 2.

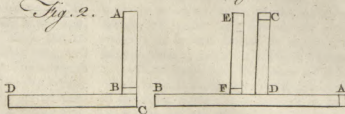


Fig. 3.

Fig. 8.

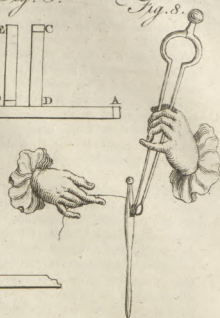


Fig. 4.



Fig. 7.

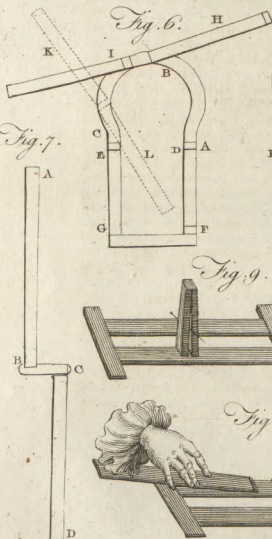


Fig. 5.



Fig. 10.

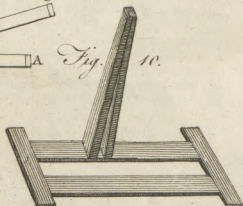


Fig. 9.

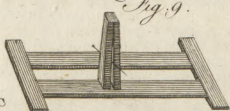


Fig. 13.



Fig. 12.



Fig. 11.



Fig. 14.

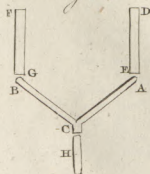


Fig. 16.

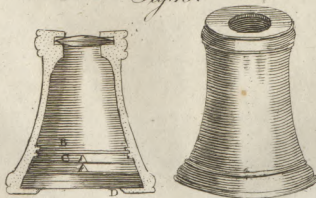
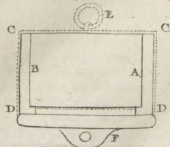


Fig. 15.



Ed. Bell Pin. H. A. Sculptor. fecit.

Theory

Theory

quently been formed of a spherical shape, with the poles and equator marked upon their surface; in which case they have got the name of *terrellas* or small earths. On breaking a magnet into two or three parts, each one becomes a perfect magnet, though they have not always an equal number of poles of the same denomination. The poles of the broken pieces generally answer to those of the whole magnet which were nearest them, though this does not always hold good.

A magnet with two poles will very readily place itself in the magnetic meridian, if suspended by a fine thread, or otherwise left at liberty to turn; but when there are more than two poles, it may happen that their opposite tendencies will counteract each other in such a manner that the magnet cannot traverse; though it will still attract and repel as though it had only two. Thus, suppose that an oblong magnet has a north polarity at both ends and a south polarity in the middle; if the north poles are both equally strong, then it is plain, that neither of them can point towards that quarter in preference to the other; but if a magnet of this kind be broken in the middle, the two parts will traverse very readily. It very seldom happens, however, that both poles are equally strong; in which case one of them will always get the better of the other, and the magnet will traverse notwithstanding its having more than two poles. The polarity of the magnet is its most valuable property, as upon it depends the construction of the magnetic needle or mariner's compass so useful in navigation; for an account of which, see the article *COMPASS*, and *NEEDLE*.

For the variation of the needle, or its declination from the true north and south direction, see the article *VARIATION*.

An account of the inclination or dipping of the magnetic needle is given under the article *DIPPING Needle*.

The directive, or polar power of a magnet, extends farther than its attractive power: thus if a magnet, freely suspended, be placed in the neighbourhood of another, it will be found that they can affect each other's direction when their attraction towards iron or towards each other cannot be perceived. This may be easily tried by placing one of them in a scale of a balance and the other at a distance below it.

CHAP. II. Theory of Magnetism.

The phenomena of magnetism, like those of electricity, depend on a cause so little subject to the investigation of our senses, that any regular and well supported theory can as yet scarcely be expected. The subject indeed is still more difficult than that of electricity; for in the latter the fluid is often made visible and otherwise perceptible by our senses; but no experiment could ever render the cause of magnetism perceptible otherwise than by its effects. The idea of its being occasioned by a fluid entering in at one pole and passing out at another, took its rise, and became pretty general, from the following experiment: Having put a small artificial magnet among some iron filings laid upon a piece of paper, give the table a few gentle knocks with your hand, so as to shake the filings a little, and they will dispose of themselves as represented in fig. 1.

VOL. X. Part II.

where A B and C D represent the two poles of the magnet, and the dotted lines the disposition of the filings. But Mr Cavallo observes, that this experiment cannot be any proof of the fluid's circulation; "because if the fluid, of whatever nature it may be, did really circulate from one pole to the other, and had any action on the filings, these would be all driven towards that pole to which the fluid directed its course. The true cause of the disposition of the filings is their becoming actually magnetic, and their two extremities being possessed of contrary polarities. Now, when there are many particles of iron near the magnet, those which touch its surface are rendered magnetic; consequently they attract other particles, and these being also rendered magnetic, attract others, and so on, forming strings of small magnets, which gradually increase in power as they recede from the magnet. As each of these particles has two magnetic poles, by a little consideration it will appear, that the farthest ends of these strings or lines which proceed from the parts adjacent to one of the poles of the magnet, for instance the north, are likewise possessed of the north polarity; and the farthest extremities of those which proceed from the parts adjacent to the south pole of the magnet, are possessed of the south polarity: hence, when they come sufficiently near, they attract the extremities of the former strings, and consequently form the curves delineated on the figure. The shaking of the table in this experiment serves to stir the filings, by making them jump up a little way, and thus place themselves in the proper situation; otherwise the action of the magnet will not have power sufficient to dispose properly those particles which stand at a considerable distance."

The late discoveries in electricity have naturally suggested another theory, viz. that the magnetic phenomena may be occasioned by a fluid analogous to the electric, or perhaps by the very same: and with a view to investigate this theory, the phenomena of magnetism and electricity have been accurately compared with each other, and the analogy between them carefully marked. This analogy is found to consist principally in the following particulars:

1. Electricity is of two kinds, positive and negative, each of which repels its own kind, and attracts the opposite. In magnetics, the north and south poles do the same; each being repulsive of its own kind of magnetism, and attracting the opposite.

2. In electricity, whenever a body in its natural state is brought near an electrified one, it becomes itself electrified, and possessed of the contrary electricity; after which an attraction takes place. In like manner, when a piece of iron or steel is brought within the influence of a magnet, it becomes itself possessed of a magnetism contrary to that which the magnet possesses, and is of course attracted.

3. One sort of electricity cannot be produced without the other, neither is it possible to produce one kind of magnetism without the other also.

4. The electric power may be retained by certain substances, as amber, glass, &c. but easily pervades other substances, which are therefore called *conductors*. Magnetism has a similar conductor in soft iron; for by means of it the virtue may be extended farther than

Plate
CCLXXVI
fig. 1.

Theory.

Theory.

than can be done without it; at the same time that the iron itself loses all magnetic power the moment it is separated from the magnet. Hardened iron, cast-iron, and steel, perform a part analogous to that of electricity; for the virtue does not easily pervade them, but is retained, and may be communicated by them to other unmagnetic pieces, in like manner as the electric virtue may be communicated to bodies by means of an excited electric. With regard to other substances, they seem not to be properly conductors of magnetism, because the fluid pervades them as though nothing were present, and they cannot transmit the virtue farther than it would go without them. With soft iron it is otherwise. Thus, if to one of the poles of a magnet we append a piece of iron of considerable length, the end farthest from the magnet will likewise attract iron with much more force than the magnet could do at that distance without it, while at the same time this attractive power is plainly that of the magnet itself, and not any way inherent in the iron, as it vanishes the moment we separate them. If a piece of hard steel of an equal length with the iron be appended to the magnet by one of its ends, we will find that the distant end will not manifest any attraction, and it will be a considerable time before the magnetic virtue can diffuse itself for any distance along it; but when the separation is made, the steel will be found to be magnetic, and will preserve its virtue for a long time.

5. The electric virtue exerts itself most powerfully on points, which are found to carry it off or receive it in vast quantities. In like manner a magnet will hold a piece of iron more powerfully by a corner, or blunt point, than by a flat surface. On sharp points indeed the magnet has but little hold by reason of the deficiency of surface.

6. From some experiments related under the article ELECTRICITY, it appears possible to superinduce the negative and positive electricities upon one another; and in magnetism it is possible to do the same. Thus, if we place a wire of some length upon a pivot, so that it can turn very easily, by touching both ends of it upon the poles of a magnet it will acquire a polarity; one end being repelled by one pole and attracted by the other. If now we give the north end, for instance, a very slight touch with the north pole of the magnet, we will find that it has a small degree of south magnetism superinduced upon it, so that on approaching the south pole of the magnet it will be repelled; but by approaching the magnet nearer, or holding the wire for a little from flying away, the south magnetism of the wire will be entirely destroyed, and the north magnetism appear as before. This experiment is not very easily made; its success depends on having the first magnetism as strong and the second as weak as possible.

These are the most remarkable particulars in which magnetism and electricity are found to agree; but the differences between them are no less remarkable than those particulars. The magnetic power affects none of our senses, and most perceptibly at least attracts only iron; while electricity attracts and repels bodies of every kind indiscriminately. The electric virtue resides on the surface, but that of the magnet pervades the whole substance. A magnet loses nothing of its power by communicating its virtue to other bodies,

but electricity always does: and, lastly, the magnetic virtue is permanent; whereas that of electricity, without the greatest care, is exceedingly perishable, and capable of being dissipated.

Notwithstanding these disagreements, however, the analogies betwixt magnetism and electricity are so great, that the hypothesis of a magnetic as well as of an electric fluid has now gained general credit; and upon this hypothesis Professor *Æpinus* has attempted to solve the phenomena of magnetism in the following manner:

1. This fluid is sufficiently subtle to penetrate the substance of all terrestrial bodies, and like the electric fluid is supposed to be repulsive of itself.

2. There is a mutual attraction between the magnetic fluid and iron, but an indifference betwixt it and all other bodies.

3. There is a great resemblance betwixt ferruginous bodies and electrics, as the magnetic fluid passes with difficulty through the former.

4. Iron and all ferruginous substances contain a quantity of magnetic fluid equally dispersed through their substance when those bodies are not magnetic. In this state they show neither attraction nor repulsion, because the repulsion between the particles of magnetic fluid is balanced by the attraction between the matter of those bodies and the fluid; in which case these bodies are said to be in a natural state: but when in a ferruginous body the quantity of magnetic fluid is driven to one, then the body becomes magnetic; one extremity of it being now overcharged with magnetic fluid and the other undercharged. Bodies thus constituted, viz. rendered magnetic, exert a repulsion between their overcharged extremities in virtue of the repulsion between the particles of that excess of magnetic fluid, which is more than overbalanced by the attraction of their matter. There is an attraction exerted between the overcharged extremity of one magnetic body and the undercharged extremity of the other, on account of the attraction between that fluid and the matter of the body: but to explain the repulsion which takes place betwixt their undercharged extremities, we must either imagine that iron when deprived of the magnetic fluid is repulsive of itself, or that the undercharged extremities appear to repel each other only because either of them attracts the opposite overcharged extremities.

A ferruginous body, therefore, according to this hypothesis, is rendered magnetic by having the equable diffusion of magnetic fluid through its substance disturbed, so as to have an overplus of it in one or more parts and a deficiency in others, its magnetism remaining as long as its impermeability prevents the restoration of the balance between the overcharged and undercharged parts. A piece of iron is rendered magnetic by the vicinity of a magnet; because when the overcharged part or pole of the magnet is presented to it, the overplus of the magnetic fluid in that pole repels the fluid away from the nearest extremity of the iron; which therefore becomes undercharged, or possessed of the contrary polarity, to the most remote part of the iron, which consequently becomes overcharged, or possessed of the same polarity as the presented pole of the magnet. When the piece of iron is rendered magnetic by presenting it to the undercharged extremity or pole of the magnet, then the

part

Theory.

Theory.

part of the iron which is nearest to it becomes overcharged, &c. because that part of the magnet, being deprived of its magnetic fluid, attracts the magnetic fluid of the iron to that extremity of the iron which lies nearest to itself.

Hence, in order to give magnetism to a piece of steel, the strength of the magnet employed must be such as to overcome the resistance which the substance of the steel makes against the free passage of the magnetic fluid : hence a piece of soft steel is rendered magnetic more easily than a hard one, and a strong magnet will render magnetic such bodies as a weak one cannot affect. When two magnets of equal power have their opposite poles presented to each other, they mutually preserve and strengthen the powers of each other ; but when poles of the same denomination are forced together, if the powers are equal, they mutually weaken each other ; or if unequal, the weaker will have its poles altered, or perhaps its attractive power entirely destroyed in a short time.

Before we make any remarks upon this hypothesis, it will be necessary to take notice of another, which Mr Cavallo considers as so well established, "that there can hardly be a philosopher sceptical enough to doubt of its truth." This is, that the earth itself is a magnet ; which position, he says, is proved almost to a demonstration in the following manner.

1. Almost all the phenomena which may be exhibited with a common magnet may also be exhibited with the earth, as far as it can be tried. And,

2. Vast masses of iron or ferruginous matter actually magnetic are dug out of the earth almost in every part of it.

In support of the above position, he adduces the phenomena of the compass, dipping-needle, and the magnetism (to be afterwards explained) which soft iron receives when properly situated. All these may be imitated by a common magnet or terrella. An objection, however, occurs, that the most remarkable phenomenon of all, viz. the attraction of iron, is wanting. No experiment has yet shown that this metal is attracted more powerfully near the poles than at the equator itself ; yet this ought very notably to be the case in such a large magnetic body. Our author indeed is of opinion, that if the experiment were tried with sufficient accuracy, the weight of the iron would be augmented by proceeding a considerable way either southward or northward. But besides that this hypothesis is as yet entirely unsupported by experiment, the difference he even supposes is quite trifling and insignificant. The dipping of the needle may indeed show that in this hemisphere there is a superiority of attraction between one end of the needle and the earth ; but it remains to be proved whether this superiority resides in the needle or in the earth itself. The following consideration indeed seems evidently to show that the power, whatever it is, resides in the needle itself ; namely, that at the equator, the needle ought to remain in an east and west direction, if so placed ; because of the equal attraction of the north and south poles. Were the needle carried to the pole itself, we can only suppose that it would point perpendicularly downwards ; in every other case, the attraction will not be perpendicular, but oblique : and supposing us to recede from the point of perpendicular attraction only a few miles,

the obliquity would become so great, that no attraction or repulsion towards that point would be distinguishable from an horizontal direction. The inclination of the needle therefore shows, that it is not actuated by the influence of a distant point in the earth ; but by some power in the atmosphere immediately acting upon the needle, and directing its course either to the earth, or from it, in a certain position.

Those who maintain the magnetism of the earth, have been considerably embarrassed with some of the natural phenomena. The variation of the compass first showed that the needle was not influenced by those points on which the earth turns round in its diurnal course : but this was easily solved by another hypothesis, viz. that the earth had two magnetical poles by which the needle is influenced, and two others round which it turns on its axis. This hypothesis was likewise embarrassed by the continual shifting of the variation either to the eastward or westward. Hence another supposition was made by Dr Halley ; namely, that there is a large magnet inclosed within the body of the earth, which not being fixed to the external part, moved with respect to it, and of consequence occasioned the variation. This was likewise overthrown, by observing that the variation of the compass was irregular, and differed so much in different parts of the world, that it could not be owing to any regular cause diffused over the whole. Four magnetic poles were then supposed to lie within the earth, and to be moveable with respect to each other ; and that therefore the variation, whose theory would now be very intricate, ought to be derived from all their actions conjointly : but, notwithstanding all this complication of poles, it might still be objected, that some kind of regularity, not observed in the variation of the magnetic compass, ought to have taken place. So that as yet there is no theory which seems to explain the variation with any kind of certainty.

The different hypotheses on this subject are more fully considered under the article VARIATION : here we shall only observe, that with respect to the magnetism of the earth, the particulars already related seem to decide against its existence. The most unambiguous proof we have of the existence of magnetism is the attraction of iron ; and this capital mark is deficient, or at least has never been employed, in the earth. The poles of all the magnets, we know, are fixed and invariable ; nor are we obliged to have recourse to magnets within magnets, or other uncouth suppositions, to account for their phenomena : if the earth is a magnet, therefore, the magnetism it possesses must be of a kind so different from the property usually distinguished by that name, that we can in no respect determine them to be the same.

Mr Cavallo is of opinion that "the magnetism of the earth arises from the magnetism of all the magnetic substances contained in it, and intermixed with other bodies ; that the magnetic poles of the earth may be considered as the centres of the polarities of all the particular aggregates of the magnetic substances ; and that those principal poles must change place relatively to the surface of the earth, according as the particular aggregates of magnetic substances within the earth are in some manner or other altered, so as to have their power diminished, increased, ap-

Theory.

Practice.

proached, or removed from the principal poles." But this seems not by any means sufficient to account for the phenomena. The magnetic needle is indeed affected by iron at a distance, but that distance is by no means considerable. A magnet or needle in a house in one street will not be affected by a smith's shop or iron warehouse in another; and there is an undoubted certainty that the magnetic needle is affected on some parts of the sea where no magnetic bodies can be present unless at a great distance on land, or below the unfathomable depths of the ocean. Besides, let us imagine as many of these bodies as we please within the surface of the earth, they must be supposed, in order to account for the phenomena of the needle, to have their poles lying all nearly the same way; which can by no means be proved to be the case: not to mention that the attraction of iron would in some places be very perceptible, which has never yet been experienced in any part of the world.

Lastly, the hypothesis of the magnetism of the earth seems to be entirely overthrown by the following curious method of giving magnetism instantaneously to an iron-bar. Take a bar of soft iron two or three feet long, and between an half and two inches thick; which description is very well answered by some kitchen poker. Place it in the magnetical line, *i. e.* the posture assumed by the dipping needle; or if a needle of this kind is not at hand, place it straight up in any degree of north or south latitude beyond 40°, or horizontally if nearer to the equator. Present then a magnetic needle to various parts of the bar; and it will be found, that in this country the lower half of the bar will repel the north end of the needle, and the upper half attract it. In south latitudes the case will be reversed; for the lower end will attract the north pole of the needle, and the upper end repel it. If the bar be not very short, its extremities will also attract small bits of iron, as filings, &c. On turning it upside down, the end which repelled the north pole of the needle before will now attract it; the reason of which is, that in the northern hemisphere the end which is nearest the earth always becomes a north pole, and in the southern hemisphere a south one. Now it is plain, that considering the distance of both poles of the earth from the iron-rod, any kind of posture in which we can place it must make a difference so trifling, that we cannot suppose the one to influence it more than the other. The whole phenomenon shows that there is in the atmosphere a current of fluid either going into the earth, or coming out from it, which influences iron when held in the direction in which itself moves. That it does not influence the metal when lying horizontally, may be owing to its want of sufficient breadth to render the effect perceptible. The earth therefore is not a magnet, but is surrounded by a fluid whose motion is productive of magnetism in iron; and most probably, though it produces this as it were accidentally, will be found to answer much more important purposes in the economy of nature. The next question then is with regard to the fluid itself: and this, from many articles in this work, will appear to be the same with that of electricity. Under the article *AURORA BOREALIS*, *ATHOUAKE, ELECTRICITY*, &c. it is shown, that the solar light, absorbed by the equatorial regions of the earth, becomes subject to

new laws of motion, acting in short as if it were another fluid, in which state we call it *electricity*, or the *electric fluid*. In this state it passes through the substance of the earth from the equator towards the polar regions, getting out again in the vicinity of the poles, ascending into the high atmospheric regions, and then returning to the equatorial parts from whence it came. On this supposition, which appears to be greatly confirmed by various natural phenomena, it is easy to see, why in the northern and southern parts the direction of the currents issuing from the earth should always become more and more perpendicular to the earth as we approach the poles, and on the contrary why their direction must be horizontal or nearly so in the equatorial parts. The discovery of this general cause therefore seems to be the nearest approach we can as yet make to the knowledge of the origin of magnetical phenomena. In what manner iron more than other metals is influenced by this fluid, or why the direction of a current of electric matter either to or from the earth, should cause such strong attractions as magnetical bodies are sometimes endowed with, we have as yet no data for understanding.

Epinus's theory of an accumulation of the electric fluid in one pole, and a deficiency of it in the other, seems not to be tenable in any respect. It is impossible to show why the mere turning of a bar upside down should accumulate the fluid, unless it was a gravitating one in the end next the earth; and though we should even make this extravagant supposition, it will be as difficult to account for the very same fluid being repelled by the earth in the southern hemisphere: for if we account the north magnetism an accumulation, we must count the south one a deficiency; or if the south magnetism is an accumulation, the opposite one must be a deficiency; and whichever supposition we adhere to, the difficulties are equally great and unformountable.

CHAP. III. Practice of Magnetism.

THIS consists in communicating the magnetic virtue from one body to another; making artificial magnets, compasses, dipping-needles, &c.; and investigating the various phenomena resulting from bodies placed in different situations.

§ 1. To communicate Magnetism by the Loadstone.

Magnetism is communicated merely by presenting a piece of iron or steel to one of the poles of a magnet or loadstone, even without touching it; though a strong and permanent power cannot be given without contact, or even stroking the one upon the other for a number of times. In this operation, that part of the ferruginous body which touches the pole of the magnet acquires the contrary magnetism; that is, if it touches the north pole, it will turn towards the south, *et vice versa*. The power acquired is strongest when soft iron is applied, weaker with hardened iron, and weakest of all with hard steel: but the permanency of it follows just the reverse of this rule; for steel or hardened iron will preserve its virtue for many years, but soft iron loses it the moment we withdraw the magnet. When we desire a strong and permanent virtue, therefore, it is best to use the hardest steel, and to impregnate it by means of one or more pow-

Practice.

erful magnets; taking care that the north pole of the magnet which gives the virtue be applied to that end of the steel which is to be made the south pole. The same method may be employed in rendering a weak magnet more powerful than before, or in restoring the virtue to one which has lost it.

The operation of communicating magnetism to pieces of steel or iron, is called *touching* them; and as this is of the utmost utility in navigation, for the purpose of giving polarity to needles, very considerable pains have been bestowed upon the subject, in order to discover the methods of giving them the magnetic virtue in the most effectual and permanent manner.—

Plate
ECLXXVI

When only one magnetic bar is to be made use of, one of its poles must be applied as represented fig. 2. where CD represents the needle or steel bar to be impregnated. The magnet A B is then to be drawn all along the surface of it, till it reaches the extremity D. The magnet being then removed, must be applied to the extremity C, and drawn over the needle as before. Thus the needle must be rubbed several times; by which means it will acquire a considerable degree of magnetism. In this method, that other extremity of the needle which the magnet touched last acquires the contrary magnetism; that is, if B be the north pole of the magnet, C will be the north pole, and D the south of the needle. This method, however, is never found to be equally effectual with that in which two magnets, or both poles of one magnet, are made use of.

To communicate magnetism by means of two magnetic bars, place the bar or needle A B, fig. 3. upon a table; then set the two magnetic bars C D, E F, straight upright upon it at a little distance, equal on both sides from the middle of the bar A B, and in such a manner that the south pole D of one of the bars may be nearest to that end of the bar A B which is to become the north pole, &c. These two bars must then be slid gradually towards one extremity of the bar, keeping them constantly at the same distance from each other; and when one of them, for instance C D, is arrived at A, then they must be slid the contrary way, till E F arrives at B; and thus the bar A B must be rubbed a greater or smaller number of times, till it will be found by trial to have acquired a considerable power. When the magnetic bars are powerful, and the bar A B of very good steel, and not very large, a dozen of strokes are fully sufficient; but when the bars are to be removed from the bar A B, care must be taken to bring them to the same situation where they were first placed; viz. at a little and equal distance from the middle of the bar A B, from whence they may be lifted up.

If it be required to communicate the greatest magnetic power possible, we may proceed in the following manner: 1. The magnetic bars may be joined at top, as in fig. 4. interposing a piece of wood, or any other substance excepting iron; for thus the opposite poles being contiguous in the upper part, strengthen each other, and of consequence the lower ones are also strengthened. 2. The bar to be rendered magnetic may be placed between the bars of soft iron, as shown in the same figure. 3. The magnetic bars may be inclined the contrary way, as recommended by Mr Epinus, making an angle of about 15 degrees with the

Practice.

bar A B. See fig. 5. In the same manner may a bar be rendered magnetic by an armed or horse-shoe magnet. In any of the methods hitherto mentioned, however, the bar to be rendered magnetic must be stroked on every side; and to let the magnetic centre fall just in its middle, care must be taken to stroke one half of the bar just as much as the other. Whenever a steel bar, or, in general, any piece of ferruginous matter, is rendered magnetic by the application of two bars, or by the two poles of one magnet, the operation is called the *double touch*, but the single touch when only one bar is applied.

Artificial magnets of a semicircular form, or shaped like a horse-shoe, have the magnetism communicated to them in the same manner with those which are straight, only the magnetic bars used for this purpose must follow the curvature of the bar to be impregnated. Thus, suppose it is required to impregnate the crooked piece of steel A B C, fig. 6. lay it flat on a table, and to its extremities apply the magnets D F, E G, joining their extremities F G with the conductor or piece of soft iron F G. Apply then the magnetic bars H I to the middle of the piece A B C, and stroke it with them from end to end, following the direction of the bent steel, so that on one side of it the magnetic bars may stand as represented by the dotted lines L K. When the piece of steel has been thus rubbed a sufficient number of times on one side, it is then to be turned, and rubbed in like manner on the other, until it has acquired a sufficient degree of magnetism.

From considering that soft iron, or soft steel, acquires magnetism very easily, though it loses it with equal facility, Mr Cavallo was induced to suppose, that if magnetism were to be communicated to a piece of hard steel while softened by heat, and the metal were then to be hardened by pouring cold water upon it while in the act of receiving the magnetism, it was possible the virtue might be first communicated to them in a very high degree, and then be fixed by means of the hardening of the steel. To determine this matter, six magnetic bars were placed in an oblong earthen vessel, in such a manner that the north poles of three of them might be opposite to the south poles of the three others, forming two parcels of bars lying in the same direction, and about three inches asunder, which was nearly the length of the steel-bar intended to be rendered magnetic. The bar was made quite red hot, and in that state was placed between the magnetic bars: Cold water was then immediately poured upon it; by which it was hardened to such a degree that the file could not touch it; but though it had thus received a considerable degree of magnetism, the power was not superior to what might have been communicated in the ordinary way. On repeating the experiment with steel-bars of different sizes, it was found that short bars receive a proportionably greater degree of power than long ones, and that, because the latter cannot be sufficiently penetrated by the magnetic power when the magnets are placed at their ends; and if a number of magnets be placed along the sides, in order to communicate a greater degree of virtue, it frequently happens that the bar acquires a number of poles. Our author is nevertheless of opinion, that this method is of considerable use: though by it we cannot communicate

Practice.

Practice.

communicate any extraordinary degree of magnetism, it is yet very useful in constructing large artificial magnets. For thus they will acquire a considerable degree of power, without any additional trouble to the workman, and may then be fully impregnated in the usual way, which cannot be done without a great deal of labour when the operation is begun upon bars which have no virtue at all.

§ 2. *To communicate the Magnetic Virtue without any Magnet either natural or artificial.*

This may be done with a soft iron-bar in the manner already related, viz. by turning it in a position perpendicular to the surface of the earth, or any other excepting a line directly perpendicular to the dipping-needle. The magnetism thus acquired, however, is always weak, and is instantaneously lost; while a steel-bar will not receive any perceptible degree of magnetism by this method. But if an iron-bar be made red hot, and left to cool in the magnetic line, or if it be repeatedly struck with a hammer while in that line, it will acquire a small degree of permanent magnetism; though this also will soon vanish by leaving the bar in an improper position, or by inverting and striking it again. The magnetism lasts longer in proportion to the hardness of the iron: but a longer time will be required to give it the degree of virtue it is capable of receiving by this method. If an iron bar is left for a long time in the direction of the magnetic line, or even in a perpendicular posture, it will sometimes acquire a great degree of power. Mr Boyle makes mention of an iron-bar, ten feet long, which had acquired so much virtue by standing in this posture, that it exceeded a loadstone of three pounds and an half weight, and would turn the needle at eight or ten feet distance. Even tongs, pokers, and other kitchen utensils, by being often heated, and set to cool again in an erect posture, are frequently observed to gain a magnetic virtue. Sometimes iron-bars, which were not capable of receiving permanent magnetism on account of their softness, have, merely by exposure to the atmosphere for a great length of time, acquired a considerable degree of power; at the same time it has been remarked, that these bars became much harder by this exposure; the cause of which has not yet been discovered.

Iron or steel acquires a very perceptible degree of magnetism by drilling, hammering, or other methods by which they are put into violent action. The cause of this magnetism Mr Cavallo looks for in the earth itself, the changeable nature of the metal by heat or cold, and the vibratory motion into which its parts are accidentally put. "For the same reasons (says he) it seems that magnetism, in certain cases, is produced by electricity; the particulars observed concerning which are the following:—When the bar or needle is laid horizontally in the magnetic meridian, whichever way the shock of an electric jar or battery enters, the end of the needle which lies towards the north acquires the north polarity, viz. the power of turning towards the north when freely suspended, the other end acquiring the south polarity. If the bar before it receives the shock has some polarity, and is placed with its poles contrary to the usual direction, then its original polarity is always diminished, and sometimes re-

versed. When the needle is struck standing perpendicularly in this hemisphere, the lower end becomes the north pole, even when it had some magnetism before, and receives the shock while standing with its south pole downwards. When all other circumstances are alike, the degree of magnetism received seems to be the same, whether the needles are struck while standing horizontally in the magnetic meridian or perpendicular to the horizon. When a needle is placed in the magnetic equator, a shock through its length very seldom renders it magnetic; but if the shock be passed through its width, it acquires the virtue, the extremity which lay towards the west generally becoming the north pole. If a needle or bar strongly magnetic, or a natural magnet, be struck by the electric shock, its power is thereby diminished. When the shock is too strong, so that the needle is thereby rendered considerably hot, it acquires either no magnetism at all or a very small degree of it. Hence a stroke of lightning often renders pieces of iron or steel magnetic, as well as those bodies which naturally contain iron, as some bricks, &c."

There are various methods of communicating a permanent magnetism to ferruginous bodies, by means of a bar rendered magnetic by the earth; of which the most simple is that described by Mr Marcel, whose experiments were made in the year 1726. Being employed in making some observations on the magnetic power which he found in great pieces of iron, he took a large vice weighing 90 pounds, in which he fixed a small anvil weighing 12 pounds. The steel to which he wished to give the magnetic virtue was laid upon the anvil in a north and south position, which happened to be the diagonal of the square surface of the latter. He then took a piece of iron an inch square, and 33 inches long, weighing about eight pounds, having one end rounded and brightly polished, the other being tapered. Holding then the steel fast upon the anvil with one hand, he took the iron-bar in the other; and holding it perpendicularly, he rubbed the steel hard with the rounded part towards him from north to south, always carrying the bar far enough round about to begin again at the north. Having thus given 10 or 12 strokes, the steel was turned upside down, and rubbed as much on the other side. Proceeding in this manner till it had been rubbed 400 times, the steel was as strongly magnetic as if it had been touched by a powerful loadstone. The place where he began to rub was always the north pole. In these experiments it sometimes happened that the virtue was imparted by a few strokes; nay, by a single one, a small needle was made to receive a very considerable power. Thus he imparted to two compass needles such a degree of magnetic power, that one took up $\frac{3}{4}$ ths and another a whole ounce of iron; and though these needles were anointed with linseed oil to keep them from rusting, and a hard coat was thus formed upon them, they nevertheless retained their virtue. Thus also a knife was made so strongly magnetical, that it would take up an ounce and three quarters of iron. Four small pieces of steel, each an inch long and $\frac{1}{16}$ th of an inch broad, as thin as the spring of a watch, were thus impregnated with the magnetic virtue, and then joined into a small artificial magnet, which at its first formation took up eight times its

Practice. own weight of iron; and after being six years kept in the most careless manner, was found to have rather gained than lost any thing of its virtue. In the course of his experiments, Mr Marcel found, that the end at which he began to rub was always the north pole, whatever position the steel was laid in. On rubbing a piece of steel from one end to the middle, and then from the other end to the middle, it acquired two north poles, one at each end, the middle being a south pole. Beginning to rub from the middle towards each end, he found a north pole in the middle and a south pole at each extremity.

Plate
CCXXVI

Magnetism may be communicated to a small piece of soft steel in the following manner. Take two iron bars of about an inch square, and upwards of three feet in length, keep them in the magnetical line, or in a perpendicular posture, as represented fig. 7. Let the piece of steel CD be either fastened to the edge of a table or held by an assistant; and placing the lower extremity of the bar AB, and the upper extremity of the bar CD, on opposite sides, and in the middle of the steel, stroke the latter from the middle towards its extremities, moving both bars at the same time. When both are arrived at the extremities of the steel, remove them from it, and apply them again to the middle. Do so for 40 or 50 times, and the steel will be found to have a considerable degree of magnetic power. Care, however, must be taken, in removing the bars, not to draw them along the surface of the steel, or the experiment will not succeed, because the magnetism is destroyed by the contrary strokes.

The late Dr Godwin Knight possessed a surprising skill in magnetism, being able to communicate an extraordinary degree of attractive or repulsive virtue, and to alter or reverse the poles at pleasure; but as he refused to discover his methods upon any terms whatever (even, as he said, though he should receive in return as many guineas as he could carry), these curious and valuable secrets have died with him. In the 69th volume of the Philosophical Transactions, however, Mr Benjamin Wilson hath given a process which at least discovers one of the leading principles of Dr Knight's art, and may perhaps be a means of discovering the whole to those who shall be less reserved. The doctor's process, according to Mr Wilson, was as follows. Having provided himself with a great quantity of clean iron-slings, he put them into a large tub that was more than one third filled with clean water; he then, with great labour, worked the tub to and fro for many hours together, that the friction between the grains of iron by this treatment might break off such smaller parts as would remain suspended in the water for a time. The obtaining of these very small particles in sufficient quantity seemed to him to be one of the principal desiderata in the experiment. The water being by this treatment rendered very muddy, he poured the same into a clean iron vessel, leaving the slings behind; and when the water had stood long enough to become clear, he poured it out carefully, without disturbing such of the sediment as still remained, which now appeared reduced almost to impalpable powder. This powder was afterwards removed into another vessel in order to dry it; but as he had not obtained a proper quantity thereof by this one step, he was obliged to repeat the process many times. Having at last procured enough of this very

fine powder, the next thing was to make paste of it, and that with some vehicle which would contain a considerable quantity of the phlogistic principle: for this purpose, he had recourse to linseed oil in preference to all other fluids. With these two ingredients only he made a stiff paste, and took particular care to knead it well before he moulded it into convenient shapes. Sometimes, while the paste continued in its soft state he would put the impression of a seal upon the several pieces; one of which is in the British Museum. This paste was then put upon wood, and sometimes on tiles, in order to bake or dry it before a moderate fire, at about the distance of a foot or thereabouts. He found that a moderate fire was most proper, because a greater degree of heat made the composition frequently crack in many places. The time required for the baking or drying of this paste was generally about five or six hours before it attained a sufficient degree of hardness. When that was done, and the several baked pieces were become cold, he gave them their magnetic virtue in any direction he pleased, by placing them between the extreme ends of his large magazine of artificial magnets for a few seconds or more as he saw occasion. By this method the virtue they acquired was such, that, when any of those pieces were held between two of his best ten-guinea bars, with its poles purposely inverted, it immediately of itself turned about to recover its natural direction, which the force of those very powerful bars was not sufficient to counteract.

In the 66th volume of the Philosophical Transactions we have the following account, from Dr Fothergill, of Dr Knight's method of imitating natural magnets, but which is by Mr Cavallo supposed to be owing to some mistake or misinformation. "I do not know (says he), that ever the doctor (Dr Knight) left behind him any description of a composition he had made to form artificial loadstones. I have seen in his possession, and many other of his friends have likewise seen, such a composition; which retained the magnetic virtue in a manner much more fixed than either any real loadstone or any magnetic bar however well tempered. In the natural ones he could change the poles in an instant, so likewise in the hardest bars; but in the composition the poles were immovable. He had several small pieces of this composition which had strong magnetic powers. The largest was about half an inch in breadth, very little longer than broad, and near a quarter of an inch thick. It was not armed, but the ends were powerfully magnetic; nor could the poles be altered, tho' it was placed between two of his largest bars, and they were very strongly impregnated. The mass was not very heavy, and had much the appearance of a piece of black lead, though not quite so shining. I believe he never divulged this composition; but I think he once told me, the basis of it was filings of iron reduced by long continued attrition to a perfectly impalpable state, and then incorporated with some pliant matter to give it due consistency."

From these accounts it appears that the basis of Dr Knight's artificial loadstones was the black powder to which iron filings are reduced by water, and which is known among the apothecaries by the name of *Martial Ethiops*: whence Mr Cavallo gives the following receipt for imitating the natural magnets.—
"Take some martial ethiops, or, which is more easily,

Practise easily procured, reduce into very fine powder the scales of iron which fall from red-hot iron when hammered, and are found abundantly in smiths shops. Mix this powder with drying linseed oil, so as to form it into a very stiff paste, and shape it in a mould so as to give it any form you require; whether of a terrella, a human head, or any other. This done, put it into a warm place for some weeks, and it will dry so as to become very hard; then render it magnetic by the application of powerful magnets, and it will acquire a considerable power."

As to the method of making artificial magnets of steel, none has succeeded in it better than Mr Canton, whose process is as follows.

Procure a dozen of bars; six of soft steel, each three inches long, one quarter of an inch broad, and one twentieth of an inch thick; with two pieces of iron, each half the length of one of the bars, but of the same breadth and thickness: also fix pieces of hard steel, each five inches and a half long, half an inch broad, and three-twentieths of an inch thick; with two pieces of iron of half the length, but the whole breadth and thickness of one of the hard bars; and let all the bars be marked with a line quite round them at one end.

Place
CCLXXXI

Then take an iron poker and tongs (fig. 8.), or two bars of iron, the larger they are and the longer they have been used, the better; and fixing the poker upright between the knees, hold to it, near the top, one of the soft bars, having its marked end downwards, by a piece of sewing silk, which must be pulled tight by the left hand, that the bar may not slide: then grasping the tongs with the right hand, a little below the middle, and holding them nearly in a vertical position, let the bar be stroked by the lower end from the bottom to the top, about ten times on each side, which will give it a magnetic power sufficient to lift a small key at the marked end: which end, if the bar was suspended on a point, would turn towards the north, and is therefore called the *north pole*; and the unmarked end is, for the same reason, called the *south pole*. Four of the soft bars being impregnated after this manner, lay the two (fig. 9.) parallel to each other, at the distance of one fourth of an inch, between the two pieces of iron belonging to them, a north and a south pole against each piece of iron: then take two of the four bars already made magnetical, and place them together so as to make a double bar in thickness, the north pole of one even with the south pole of the other: and the remaining two being put to these, one on each side, so as to have two north and two south poles together; separate the north from the south poles at one end by a large pin, and place them perpendicularly with that end downward on the middle of one of the parallel bars, the two north poles towards its south and the two south poles towards its north end: slide them backward and forward three or four times the whole length of the bar, and removing them from the middle of this, place them on the middle of the other bar as before directed, and go over that in the same manner; then turn both the bars the other side upwards, and repeat the former operation: this being done, take the two from between the pieces of iron; and, placing the two outermost of the touching bars in the room, let the other two be the outermost of the four to touch these with; and this process being repeated till each pair of bars have been

N. 191.

touched three or four times over, which will give them a considerable magnetic power, put the half-dozen together after the manner of the four (fig. 10.), and touch them with two pair of the hard bars placed between their irons, at the distance of about half an inch from each other: then lay the soft bars aside; and with the four hard ones let the other two be impregnated (fig. 11.), holding the touching bars apart at the lower end near two tenths of an inch; to which distance let them be separated after they are set on the parallel bar, and brought together again before they are taken off: this being observed, proceed according to the method described above, till each pair have been touched two or three times over. But as this vertical way of touching a bar will not give it quite so much of the magnetic virtue as it will receive, let each pair be now touched once or twice over in their parallel position between the irons (fig. 12.), with two of the bars held horizontally, or nearly so, by drawing at the same time the north pole of one from the middle over the south end, and the south of the other from the middle over the north end of a parallel bar; then bringing them to the middle again, without touching the parallel bar, give three or four of these horizontal strokes to each side. The horizontal touch, after the vertical, will make the bars as strong as they possibly can be made, as appears by their not receiving any additional strength, when the vertical touch is given by a great number of bars, and the horizontal by those of a superior magnetic power. This whole process may be gone through in about half an hour; and each of the large bars, if well hardened, may be made to lift 28 Troy ounces, and sometimes more. And when these bars are thus impregnated, they will give to an hard bar of the same size its full virtue in less than two minutes; and therefore will answer all the purposes of magnetism in navigation and experimental philosophy much better than the loadstone, which is known not to have a sufficient power to impregnate hard bars. The half dozen being put into a case (fig. 13.) in such a manner as that two poles of the same denomination may not be together, and their irons with them as one bar, they will retain the virtues they have received; but if their power should, by making experiments, be ever so far impaired, it may be restored without any foreign assistance in a few minutes. And if, out of curiosity, a much larger set of bars should be required, these will communicate to them a sufficient power to proceed with; and they may, in a short time, by the same method, be brought to their full strength.

To expedite the process of making magnets, the bars should be fixed in a groove, or between brass pins, to prevent them from sliding; or they may be kept steady by means of a weight and ruler, as in fig. 11.

§ 3. Apparatus for making Experiments in Magnetism, with an Account of various Experiments tending to illustrate and prove the Laws already laid down.

THE apparatus necessary in magnetics is but small, consisting only of a few magnets or magnetic bars, a magnetic horizontal needle or compass, and a dipping needle. For those who do not intend to be very accurate, a common artificial horse-shoe magnet and a few sewing needles may be sufficient; but where greater accuracy is required, it will then be necessary to have

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Practice.

Practice.

have a good set of magnetic bars, commonly fix; a few small magnetic needles, a larger needle in a box with a graduated circle, and a dipping needle; to which may be added some pieces of steel-wire, a few bars of soft iron, &c.

The magnetic bars ought to be made of the best steel, and tempered quite hard. There is not, however, any method known as yet by which we can distinguish the kind of steel which is best for magnetical purposes. It will be proper, therefore, previous to the construction of the bars, to try the quality of the metal in the following manner: Take a piece of it about three inches long and a quarter of an inch thick, no matter whether round or square; make it red-hot, and in that condition plunge it into cold water, which hardens it so that a file will not touch it. Apply then two powerful magnetic bars; holding the north pole of one to one extremity of the steel, and the south-pole of the other magnet to the other extremity of the steel. Having kept them in this position for about a minute, separate them from the steel, and then try whether it will keep suspended a key or other piece of iron which may be at hand. By treating in this manner pieces of different steel, it will easily be perceived which is capable of lifting the greatest weight, and consequently the most proper for the construction of the bars.

Having determined the quality of the material, the next thing to be considered is the shape of the bars; for unless the length and breadth of them bear a certain proportion to each other, they will not be capable of receiving their utmost power. The best shape, according to Mr Cavallo, is when the length is ten times the breadth and 20 times the thickness. The usual dimensions are five inches in length, half an inch in breadth, and a quarter of an inch in thickness. Cylindrical bars are less convenient.—It is not absolutely necessary to polish these bars; though it will be better to do so, they being in this state much less liable to rust. One extremity is generally marked with a line all round, to distinguish one pole from another; and it is the north pole which is usually marked in this manner. When kept together, the magnetic bars must be placed alternately with the marked end of one contiguous to the unmarked end of the other. Two pieces of soft iron called *supports* always belong to each set of bars. Each of these is equal in size to the half of one of the bars; so that when placed contiguous to one another in one direction, they may equal one of the bars. These are useful when other bodies are to be rendered magnetic. For the construction of the *COMPASS* and *DIPPING-NEEDLE*, see these articles.

Experiments with the above described Apparatus.

1. *To determine whether any substance is attracted by the magnet or not.*—If the substance to be examined contains iron, the attraction will evidently show itself on bringing near it one of the magnetic bars. The quantity of attraction will always be known by the force requisite to separate them, and its proportion is estimated by the degree of that force. Thus if two ounces are required to separate a magnet from any substance, the degree of attraction is reckoned double to that which requires only one ounce to separate them. If the attraction be so small that it cannot

be perceived in this way, it must be put to swim upon water in an earthen or wooden vessel, by means of a piece of wood or cork. In this way the attraction will be much more easily manifested by the body coming towards the magnet when approached to it. It will sometimes be necessary to bring the magnet within one-tenth part of an inch of the body to be attracted; and as the latter advances, care must be taken to withdraw the magnet; for if they be suffered to strike against each other, the body, if hard, will generally recede; and it will likewise be proper to prevent the magnet to the body when the latter is at rest.

By letting the substances to be attracted swim upon quicksilver, a still smaller degree of attraction can be perceived. In using this fluid, the following particulars must be attended to. 1. The aperture of the vessel in which the quicksilver is kept must be at least six inches in diameter. The reason of this is, that, as the surface of the quicksilver descends near the sides of the vessel, the curvature of surface formed by that descent is proportionably greater in the narrow vessels than larger ones. If the vessel is only three or four inches in diameter, the body to be attracted will perpetually run from one side to another: a common soup-plate, however, will be found a very convenient vessel for this purpose. 2. It will be necessary to have the quicksilver very pure; and as it is very difficult to preserve it in that state, it must be frequently passed through a piece of writing paper rolled up conically, and having a small aperture of about $\frac{1}{16}$ th of an inch diameter in the lower part. 3. The neighbouring air must not be disturbed, that the body may be kept without motion; and, while in this state, one of the poles of the magnet is to be presented to it in the same manner as when the experiment is tried with water. It was in this manner that Mr Cavallo made his experiments on the magnetism of brass and other metals, of which we have already given an account.

If it be suspected that the given body have some magnetism already, the very same process is required; only observing to present a piece of soft and clean iron to the body when swimming upon water or quicksilver. A piece of iron about half an ounce weight, and an inch in length, will be very proper for this purpose.

2. *To find the poles of a magnetic body.*—Present the various parts of the body successively to one of the poles of a magnetic needle, and it will soon be discovered which parts of the given body are possessed of a contrary polarity by the needle's standing perpendicularly towards them. One of the poles being thus discovered, turn the opposite pole of the magnetic needle towards the body, and it will soon find out its other pole. When the magnetism of the body to be examined is very weak, there will be danger of reversing the polarity by bringing the needle too near; and as the distance at which this effect will take place cannot be determined, it will always be proper to keep it so far distant that it can only sensibly affect the needle. Where there are only two poles, they may be found out merely by sprinkling some iron-filings upon the body; for these will stand erect upon the polar points. They may be distinguished by setting the body to float in water, or tying it to a thread and letting it hang

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freely, so that one may turn towards the north and the other towards the south. This method, however, will not succeed when there are more than two poles, nor even very well in that case, unless they lie in parts directly opposite to one another.

3. *Effects of the magnet on soft iron.*—Having placed a magnetic needle upon a table, bring a bar of soft iron about eight inches long and a quarter of an inch thick, so near that it may draw one end of the needle a little out of the way. In this situation approach gradually the north pole of a magnet to the other extremity of the bar, and the north end of the needle will recede from the bar more and more in proportion as the magnet is brought nearer the bar. If the experiment be repeated with the other pole of the magnet, the north end of the needle will then be attracted by the bar. The reason of this is, that when we bring the north pole of the magnet towards one end of the bar, the latter acquires a south polarity, and the other one of course a north polarity. Hence the needle is repelled, because magnetic poles of the same kind repel one another; but when the south pole is brought near the end of the bar, that end which it approaches receives the north polarity, and the other of course the south; whence the needle, instead of being repelled, is now attracted. By approaching a small magnetic needle to different parts of the bar, it will be found that one half of it possesses one kind of polarity, and the other the contrary kind; the magnetic centre, however, or the limit betwixt the two polarities, is not always in the middle of the bar, but is generally nearer that end which is presented to the magnet. The difference increases as the bar is lengthened; and when the latter exceeds a certain length, it acquires several poles. This depends on the strength of the magnet; and when it happens, the first magnetic centre comes very near to the end of the bar which stands next the magnet, and successive centres are formed betwixt every two poles. Thus, supposing the north pole of a magnet to be brought to the end of such a bar, the end it touches becomes a south pole; a few inches farther a north polarity takes place, after that a south polarity, and so on. The poles become weaker and weaker as they recede from the end which the magnet touches; so that if the bar be of considerable length, they totally vanish long before they come to the other end. Hence, by applying a magnet to one end of a long bar, we will not thereby give any magnetism to the other; and this will happen when a magnet capable of lifting two pounds of iron is applied to a bar of about an inch square and five feet long.

4. *The action of magnetism shown by the repulsion of two pieces of wire.*—Tie two pieces of soft wire each to a separate thread, and having suspended them close by each other, bring one of the poles of a magnet under them, and they will immediately repel; the divergency becoming greater as the magnet is brought nearer within a certain limit, and will decrease as the magnet is removed. If steel-wires or common sewing needles be used, the repulsion will continue for a considerable time after the magnet is removed; and this divergency will even be greater after the removal of the magnet, as its attraction tends to draw them nearer each other; and, if brought too near, no repulsion will be shown by them. The experiment may be a-

greatly diversified by using four or more needles, and presenting a north pole to one pair and a south pole to another, &c.

5. *In what circumstances a magnet can lift the greatest weight.*—By means of a crooked wire we may show that the power of a magnet varies according to circumstances. Thus, let a piece of wire about a quarter of an inch in diameter, and four or five inches long, be bent in the manner represented by ACB, fig. 14. with a sharp corner at C. Tie it fast to a cross bar, or let it be held by an assistant with the corner downwards. Then apply either pole of the magnet DE to one of its extremities; and if in this situation a small piece of iron, as H, be put to the corner C, it will remain suspended. On applying the contrary pole of another magnet to the other extremity of the wire, the piece of iron will immediately fall off; but if a pole of the same kind be applied, it will not only be still kept suspended, but be more strongly attracted than before.

In the case just mentioned, the first magnet is assisted by the action of the second; but in order to strengthen a magnet in this manner, it does not appear necessary to use a magnet at all. Thus, having found by trial how much a magnetic bar can lift, procure an oblong piece of iron about four inches long, and somewhat heavier than the bar can bear. Apply one end of this to the pole of the bar, holding it with your hand till you place under the other end a larger piece of iron. It will then be found that the magnet will support the piece of iron which it could not do before. The lower piece of iron is to be placed between an half and three quarters of an inch below the under part of the oblong piece which hangs at the magnet. The same effect will be produced by the opposite pole of another magnet; but a pole of the same denomination would weaken the attraction.

6. *The generation of poles, and of magnetic centres in the parts of a broken magnet.*—Take a magnetic bar about six or eight inches long and a quarter of an inch diameter, whose magnetic centre will be in the middle, or near it. Break off about one third part by a smart stroke of an hammer, and it will be found that the broken part, though in the magnet it had but one polarity, will now have acquired a north and south pole, with a magnetic centre, as if it were a distinct magnet. The experiment may be diversified as follows: Having made a steel bar about six inches long and a quarter of an inch thick quite hard, break it into two unequal parts. Join these, and press them hard together, giving it the magnetic virtue at the same time by means of two powerful magnets: while the parts remain in this position, so that the bar looks as if it had not been broke, it will have only two poles; but as soon as they are separated, each part will be found to become a distinct magnet, having a north and south pole proper to itself.

7. *To remove the magnetic centre in a magnet.*—This may be done in various ways; as, by striking a magnetic bar repeatedly, heating it, hard rubbing, &c.; but in all these methods the magnetism of the bar is diminished at the same time that the centre is removed; so that they ought not to be continued beyond what is necessary to produce a sensible removal of the magnetic centre.

Plate
CCLXXVI

Practice.

Practice.

8. *The disadvantages of using magnets of unequal power, and of steel not properly hardened.*—Having communicated the magnetic virtue to a steel-bar by means of a magnet of any given power, then rub it with a weaker magnet, and it will be found, that the power of the bar, instead of being augmented, will now be diminished; being no stronger than if it had been rubbed only with the weak magnet. The impropriety of using soft steel in making artificial magnets may be understood from the following example: Take two wires about 14 inches long, and one eighth of an inch in thickness; let one be of very hard steel, the other of soft steel or iron, though not of the softest sort: then, by means of magnetic bars, give the virtue to those wires, treating them both in the same manner, and it will be generally found that the hard wire will have only two poles, but the other a greater number.

9. *To weaken or destroy the magnetism of a wire by bending.*—Having communicated the magnetic virtue to an iron or soft steel wire of about four or five inches long and one-twentieth of an inch in diameter, roll it round a stick so as to make four or five revolutions. When taken off the stick it will be found to have its virtue quite destroyed, or at least very much weakened by the bending. This effect cannot be produced but when the texture of the wire is strained by the bending; for if it be of such an elastic nature as to recover its straightness after being once rolled round the stick, little change is made on the magnetic power. When only the middle of the wire is bent, little or no change takes place in the magnetic power. If a piece of magnetic wire be cleft, or split lengthwise, the parts will sometimes have the same poles, and sometimes the contrary; but when one part is much thinner than the other, the slender part will generally have its poles reversed.

10. *To improve natural magnets.*—This may be done by the same methods which are used to communicate the virtue to steel-bars or to iron-ores: but the natural magnets being generally very short, we can seldom do more than place them between two strong magnetic bars: However, when they are of sufficient length, they must be rubbed with other bars besides those between which they are put; using the same precautions as in making artificial magnets. When subjected to this operation, it will always be proper to remove the armature from them.

11. *To arm natural or artificial magnets.*—The first step towards this operation is to find out the poles of the magnet, after which it is to be properly shaped; that of a parallelepipedon is the best: in which case care must be taken to let the poles fall about the middle of two opposite surfaces; and in this direction the magnet ought to have the greatest length possible; for a natural magnet is weakened much more by having a part cut off from its length than its breadth. This being done, provide two plates of soft iron, equal in breadth to those surfaces where the poles stand, and projecting a little on one side of the stone, as shown by fig. 15. The projections marked DD must be much narrower than the breadth of the plates; from a quarter to half an inch being sufficient for the larger magnets, and about one tenth of an inch for small ones, for the purpose of applying to them the surface of the iron F. The thickness of the plates CD CD must be

proportioned to the strength of the magnet AB; and this proportion cannot easily be determined without an actual experiment. The best method, therefore, is to make them somewhat thick at first, and then keep filing them down as long as the power of the magnet increases; after which the filing is to be discontinued. The armature may be kept on either by tying or by a box; which last is the preferable method. The armature of spherical magnets must be adapted to their shape, and each large enough to cover a quarter of it. In like manner may artificial magnets be armed, and thus a compound magnet may be produced much more powerful than any single one. Thus Dr Knight constructed two very powerful artificial magnets, or magazines of magnetic bars, which are now in the repository of the Royal Society. Each of these consists of 240 bars disposed in four lengths, so as to form a parallelepipedon, each length containing 60 bars. They are all kept together by iron braces, and the whole suspended on pivots, with a wooden pedestal or carriage, by which they may be easily placed in any required position. If the artificial magnets be made in the shape of a horse-shoe or a semicircle, they have no occasion for armature, it being sufficient to join them either by rivetting or by means of a box; and indeed even when straight bars are used, a compound magnet may be made without armature; but then as the poles cannot act in the same plain, it is necessary to have two magazines in order to give magnetism the more conveniently to other bodies. The power of a magnet is rather augmented by being armed, for the same reason that it is increased by a piece of iron affixed to it. E is a brafs ring, by which it may be suspended with the iron adhering to it, which is the best method for preserving its virtue.

12. *Magnetism requires some time to penetrate through iron.* Having placed a bulky piece of iron, suppose one weighing 40 or 50 pounds, so near a magnetic needle as to draw it a little out of its direction, apply one of the poles of a strong magnet to the other extremity of the iron, and you will find that it requires some seconds before the needle can be affected by it. The interval is greater or less according to the size of the iron and the strength of the magnet.

CHAP. IV. Entertaining Experiments.

Construction of the MAGNETIC PERSPECTIVE-GLASS.] Provide an ivory tube, about two inches and a half long, and of the form expressed in fig. 16. The sides of this tube must be thin enough to admit a considerable quantity of light. It is to open at one end with a screw; at that end there must be placed an eye-glass of about two inches focus, and at the other end any glass you please. Have a small magnetic needle, like that placed on a compass. It must be strongly touched, and so placed at the bottom of the tube that it may turn freely round. It is to be fixed on the centre of a small ivory circle C, of the thickness of a counter, which is placed on the object-glass D, and painted black on the side next it. This circle must be kept fast by a circular rim of pasteboard, that the needle may not rise off its pivot, after the same manner as in the compass. This tube will thus become a compass, sufficiently transparent to

Plate
CCLXXXI

show the motions of the needle. The eye-glass serves more clearly to distinguish the direction of the needle; and the glass at the other end, merely to give the tube the appearance of a common perspective. It will appear from the laws of magnetism already laid down, that the needle in this tube, when placed over, and at a small distance from, a magnet, or any machine in which it is contained, will necessarily place itself in a position directed by that magnet, and consequently show where the north and south pole of it is placed; the north end of the needle constantly pointing to the fourth end of the magnet. This effect will take place, though the magnet be inclosed in a case of wood, or even metal, as the magnetic effluvia penetrates all bodies. You must observe, however, that the attracting magnet must not be very far distant from the needle, especially if it be small, as in that case its influence extends but to a short distance. This tube may be differently constructed, by placing the needle in a perpendicular direction, on a small axis of iron, on which it must turn quite freely, between two small plates of brass placed on each side the tube: the two ends of the needle should be in exact equilibrium. The north and south ends of this needle will, in like manner, be attracted by the fourth and north ends of the magnetic bar. The former construction, however, appears preferable, as it is more easily excited, and the situation of the needle much more easily distinguished.

EXP. I. *The magnetic paradox.*

Plate
CCLXXVII.

HAVING placed a small piece of iron wire not above a tenth part of an inch long upon a table A B, fig. 17. Hold the magnetic bar E F about four or five inches above the table, with either of its poles pointing to the table, and so that the perpendicular let fall from the pole may touch the table at G, two or three inches from the wire; which distances, however, are subject to variations arising from the power of the magnet.—When the magnet is held in a proper position with respect to the iron, the latter will elevate one of its ends, as is shown at C D, forming an angle with the table, which is larger the nearer the wire comes to the point G, where it stands quite upright. Knock the table gently, and the wire C D will gradually proceed towards G, every knock making it jump up and advance a little way. This will naturally be attributed to the attraction of the magnet; which not being sufficiently strong to draw the wire directly towards it, is just able to bring it gradually towards G when the motion of the table lifts it up. But if, instead of holding the magnet over the table, it be placed below it at H I, the wire will now make an obtuse angle towards G; as is shown at K L, and, on knocking the table, will recede from the magnet as if repelled, though in truth it is as much attracted as before.

The cause of this seeming repulsion will be understood from fig. 18. where the wire is represented by K L and the magnet by H. The former being rendered magnetic by the proximity of the magnet H, is inclined to it according to the laws already laid down; but, by reason of its weight, and being supported only at one end, it inclines less than it would do if it were freely suspended by its centre. Let M N be a line passing through the centre of the wire; then,

by the motion of the table, the wire being lifted up, the end K will be at liberty to descend farther in the direction in which it is attracted by the magnet than it was before. It will then take the position represented by r Q, its centre remaining nearly in the same perpendicular M N. We say nearly, because the action of the magnet will undoubtedly move the whole wire somewhat nearer to itself; and the motion of the centre will be a diagonal compounded of the forces of gravity and of the magnet. The latter, however, being much smaller, will, by conspiring with the action of gravity, draw down the nearest end of the wire r so far, that a perpendicular line P O let fall from the extremity of it will touch the table in a point farther distant from the magnet than K. In this perpendicular the wire will depend very nearly, and then resume its proper situation, parallel, or nearly so, to K L; when a second knock will remove it a little farther off, for the reason already assigned. The former part of the experiment may be easily explained upon the same principles. The whole may be diversified by using iron filings instead of the wire. In this case, when the magnet is held over the table, they will be gradually collected about the point G, and dispersed from it while the magnet is held under.

2. *The communicative crown.*

TAKE a crown-piece, and bore a hole in the side of it; in which place a piece of wire, or a large needle, well polished, and strongly touched with a magnet. Then close the hole with a small piece of pewter, that it may not be perceived. Now the needle in the magnetic perspective before described, when it is brought near to this piece of money, will fix itself in a direction correspondent to the wire or needle in that piece. Desire any person to lend you a crown-piece, which you dexterously change for one that you have prepared as above. Then give the latter piece to another person, and leave him at liberty either to put it privately in a snuff-box, or not; he is then to place the box on a table, and you are to tell him, by means of your glass, if the crown is or is not in the box. Then bringing your perspective close to the box, you will know, by the motion of the needle, whether it be there or not; for as the needle in the perspective will always keep to the north of itself, if you do not perceive it has any motion, you conclude the crown is not in the box. It may happen, however, that the wire in the crown may be placed to the north, in which case you will be deceived. Therefore, to be sure of success, when you find the needle in the perspective remain stationary, you may make some pretence to desire the person to move the box into another position, by which you will certainly know if the crown-piece be there or not.—You must remember, that the needle in the perspective must here be very sensible, as the wire in the crown cannot possibly have any great attractive force.

3. *The magnetic table.*

UNDER the top of a common table place a magnet that turns on a pivot; and fix a board under it, that nothing may appear. There may also be a drawer under the table, which you pull out to show that there is nothing concealed. At one end of the table there
must

Fig. 17.

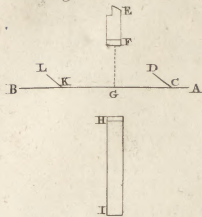


Fig. 18.

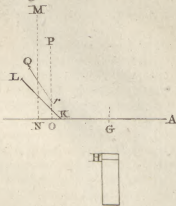


Fig. 19.

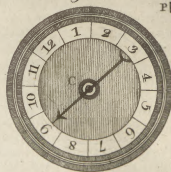


Fig. 20.

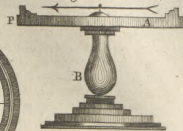


Fig. 21.



Fig. 22.

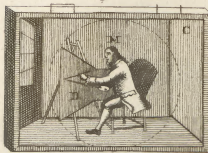


Fig. 23.



Fig. 25.



Fig. 27.

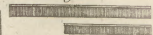


Fig. 24.



Fig. 26.



Fig. 28.

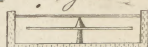


Fig. 29.

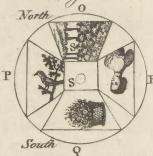


Fig. 30.

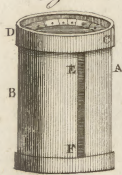


Fig. 31.



Fig. 33.



Fig. 34.



Fig. 32.



Fig. 36.

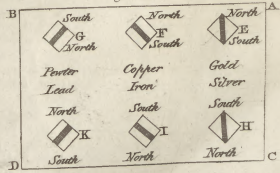


Fig. 35.



N^o 1. North



N^o 2. North



N^o 3. North



N^o 4. South



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must be a pin that communicates with the magnet, and by which it may be placed in different positions: this pin must be so placed as to be visible to the spectators. Strew some steel-slings or very small nails over that part of the table where the magnet is. Then ask any one to lend you a knife, or a key, which will then attract part of the nails or filings. Then placing your hand in a careless manner on the pin at the end of the table, you alter the position of the magnet; and giving the key to any person, you desire him to make the experiment, which he will then not be able to perform. You then give the key to another person; at the same time placing the magnet, by means of the pin, in the first position, when that person will immediately perform the experiment.

4. *The mysterious watch.*

You desire any person to lend you his watch, and ask him if he thinks it will or will not go when it is laid on the table. If he say it will, you place it over the end of the magnet, and it will presently stop (A). You then mark with chalk, or a pencil, the precise point where you placed the watch; and moving the position of the magnet, as in the last experiment, you give the watch to another person, and desire him to make the experiment; in which he not succeeding, you give it to a third person, at the same time replacing the magnet, and he will immediately perform the experiment.

5. *The magnetic dial.*

PROVIDE a circle of wood or ivory, of about five or six inches diameter, as fig. 19, which must turn quite free on the stand B (fig. 20.) in the circular border A: on the circle must be placed the dial of pasteboard C (fig. 19.) whose circumference is to be divided into 12 equal parts, in which must be inscribed the numbers from 1 to 12, as on a common dial. There must be a small groove in the circular frame D, to receive the pasteboard circle: and observe, that the dial must be made to turn free, that it may go round without moving the circular border in which it is placed. Between the pasteboard circle and the bottom of the frame, place a small artificial magnet E (fig. 21.), that has a hole in its middle, or a small protuberance. On the outside of the frame place a small pin P, which serves to show where the magnetic needle I, that is placed on a pivot at the centre of the dial, is to stop. This needle must turn quite free on its pivot, and its two sides should be in exact equilibrium. Then provide a small bag, that has five or six divisions, like a lady's work-bag, but smaller. In one of these divisions put small square pieces of pasteboard, on which are wrote the numbers from 1 to 12, and if you please you may put several of each number. In each of the other divisions you must put 12 or more like pieces; observing, that all the pieces in each division must be marked with the same number. Now the needle being placed upon its pivot, and turned quickly about, it will necessarily stop at that point where the north end of the magnetic bar is placed, and which you previously know by the situation of the small pin in the circular border. You therefore pre-

sent to any person that division of the bag which contains the several pieces on which is wrote the number, opposite to the north end of the bar, and tell him to draw any one of them he pleases. Then placing the needle on the pivot, you turn it quickly about, and it will necessarily stop, as we have already said, at that particular number.

Another experiment may be made with the same dial, by desiring two persons to draw each of them one number out of two different divisions of the bag; and if their numbers, when added together, exceed 12, the needle or index will stop at the number they exceed it; but if they do not amount to 12, the index will stop at the sum of those two numbers. In order to perform this experiment, you must place the pin against the number 5, if the two numbers to be drawn from the bag be 10 and 7; or against 9 if they be 7 and 2.—If this experiment be made immediately after the former, as it easily may, by dexterously moving the pin, it will appear the more extraordinary.

6. *The dexterous painter.*

PROVIDE two small boxes, as M and N (fig. 22), four inches wide, and four inches and a half long. Let the box M be half an inch deep, and N two-thirds of an inch. They must both open with hinges, and shut with a clasp. Have four small pieces of light wood, (fig. 23, 24, 25, 26.) of the same size with the inside of the box M (fig. 22.), and about one third of an inch thick. In each of these let there be a groove, as AB, EF, CD, GH; these grooves must be in the middle, and parallel to two of the sides. In each of these grooves place a strong artificial magnet, as fig. 27. The poles of these magnets must be properly disposed with regard to the figures that are to be painted on the boards; as is expressed in the plate. Cover the bars with paper, to prevent their being seen; but take care, in pasting it on, not to wet the bars, as they will thereby rust, which will considerably impair their virtue. When you have painted such subjects as you choose, you may cover them with a very thin clear glass. At the centre of the box N, place a pivot (fig. 28.), on which a small circle of pasteboard OPQR (fig. 29.) is to turn quite free; under which is to be a touched needle S. Divide this circle into four parts, which are to be disposed with regard to the poles of the needle, as is expressed in the figure. In these four divisions you are to paint the like subjects as are on the four boards, but reduced to a smaller compass. Cover the inside of the top of this box with a paper M, (see fig. 22.) in which must be an opening D, at about half an inch from the centre of the box, that you may perceive, successively, the four small pictures on the pasteboard circle just mentioned. This opening is to serve as the cloth on which the little painter is supposed to draw one of the pictures. You may cover the top of the box, if you please, with a thin glass. Then give the first box to any person, and tell him to place any one of the four pictures in it privately, and when he has closed it, to give it you. You then place the other box over it; when the moveable circle, with the needle, will turn till it comes in the same position with the bar in the first

first

(A) To perform this experiment, you must use a strong magnetic bar; and the balance of the watch must not be of brass, but steel.

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first box. It will then appear that the little dexterous painter has already copied the picture that is inclosed in the first box.

7. *The cylindric oracle.*

PROVIDE a hollow cylinder of about six inches high and three wide, as AB, fig. 30. Its cover CD must be made to fix on any way. On one side of this box or cylinder let there be a groove, nearly of the same length with that side; in which place a small steel bar (fig. 31.) that is strongly impregnated, with the north pole next the bottom of the cylinder. On the upper side of the cover describe a circle; and divide it into ten equal parts, in which are to be wrote the numbers from 1 to 10, as is expressed in fig. 32. Place a pivot at the centre of this circle, and have ready a magnetic needle. You are then to provide a bag, in which there are several divisions, like that described in exper. 5. In each of these divisions put a number of papers, on which the same or similar questions are wrote. In the cylinder put several different answers to each question, and seal them up in the manner of small letters. On each of these letters or answers is to be wrote one of the numbers of the dial or circle at the top of the box. You are supposed to know the number of the answers to each question. You then offer one of the divisions of the bag, observing which division it is, to any person, and desire him to draw one of the papers. Next put the top on the cylinder, with that number which is wrote on the answer directly over the bar. Then placing the needle on the pivot, you turn it briskly about, and it will naturally stop at the number over the bar. You then desire the person who drew the question to observe the number at which the needle stands, and to search in the box for a paper with the same number, which he will find to contain the answer.—You may repeat the experiment by offering another division of the bag to the same or another person; and placing the number that corresponds to the answer over the magnetic bar, proceed as before.

It is easy to conceive of several answers to the same question. For example, suppose the question to be, Is it proper to marry?

Answer 1. While you are young, not yet; when you are old, not at all.

2. Marry in haste, and repent at leisure.

3. Yes, if you can get a good fortune; for something has some favour, but nothing has no flavour.

4. No, if you are apt to be out of humour with yourself; for then you will have two persons to quarrel with.

5. Yes, if you are sure to get a good husband (wife); for that is the greatest blessing of life. But take care you are sure.

6. No, if the person you would marry is an angel; unless you will be content to live with the devil.

8. *The enchanted ewer.*

Fix a common ewer, as A, (fig. 33.) of about 12 inches high, upon a square stand BC; in one side of which there must be a drawer D, of about four inches square and half an inch deep. In the ewer place a hollow tin cone, inverted, as AB, fig. 34. of about four inches and a half diameter at top, and

two inches at bottom; and at the bottom of the ewer there must likewise be a hole of two inches diameter.

Upon the stand, at about an inch distance from the bottom of the ewer, and directly under the hole, place a small convex mirror H, of such convexity that a person's visage, when viewed in it, at about 15 inches distance, may not appear above two inches and a half long.

Upon the stand likewise, at the point I, place a pivot of half an inch high, on which must be fixed a touched needle RQ, inclosed in a circle of very thin pasteboard OS, fig. 35. of five inches diameter. Divide this pasteboard into four parts, in each of which draw a small circle; and in three of these circles paint a head as x, y, z , the drefs of each of which is to be different, one, for example, having a turban, another a hat, and the other a woman's cap. Let that part which contains the face in each picture be cut out, and let the fourth circle be entirely cut out; as it is expressed in the figure. You must observe, that the poles of the needle are to be disposed in the same manner as in the plate.

You are next to provide four small frames of wood or pasteboard, n^o 1, 2, 3, 4, each of the same size with the inside of the drawer. On these frames must be painted the same figures as on the circular pasteboard; with this difference, that there must be no part of them cut out. Behind each of these pictures place a magnetic bar, in the same direction as is expressed in the plate; and cover them over with paper, that they may not be visible. Matters being thus prepared, you first place in the drawer the frame n^o 4. on which there is nothing painted. You then pour a small quantity of water into the ewer, and desire the company to look into it, asking them if they see their own figures as they are. Then you take out the frame n^o 4. and give the three others to any one, desiring him to choose in which of those dresses he would appear. Then put the frame with the drefs he has chose in the drawer; and a moment after, the person looking into the ewer will see his own face surrounded with the drefs of that picture. For, the pasteboard circle (divided, as above described, into four parts, in three of which are painted the same figures as on three of the boards, and the fourth left blank) containing a magnetic needle, and the four boards having each a concealed magnet; therefore, when one of them is put in the drawer under the ewer, the circle will correspond to the position of that magnet, and consequently the person looking into the top of the ewer will see his own face surrounded with the head-dress of the figure in the drawer.—This experiment, well performed, is highly agreeable. As the pasteboard circle can contain only three heads, you may have several such circles, but you must then have several other frames; and the ewer must be made to take off from the stand.

9. *The box of metals.*

PROVIDE a wooden box, about 13 inches long and seven wide, as ABCD (fig. 36.). The cover of this box should be as thin as possible. Have six small boxes or tables, about an inch deep, all of the same size and form, as EFGHIK, that they may indiscrimi-

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CCLXXXVII

nately go into similar holes made in the bottom of the large box. In each of these tablets is to be placed a small magnetic ball, and their poles are to be disposed as expressed in the figure. Cover each of these tablets with a thin plate of one of the six following metals, viz. gold, silver, copper, iron, pewter, and lead. You must also have a magnetic perspective, at the end of which is to be two circles, one divided into six equal parts, and the other into four, as in fig. 37. from the centre of which there must be drawn an index N, whose point is to be placed to the north. Therefore, when you are on the side CD of the box, and hold your perspective over any one of the tablets that are placed on the holes E, F, G, so that the index drawn on the circle is perpendicular to the side AB, the needle in the perspective will have its south pole directed to the latter that denotes the metal contained in that tablet. When you hold the perspective over one of the boxes placed in the holes H, I, K, so that the index drawn on the circle is perpendicular to the side CD, the south pole of the needle will in like manner express the name of the metal inclosed. If the under side of any one of the tablets be turned upwards, the needle will be slower in its motion, on account of the greater distance of the bar. The gold and silver will still have the same direction; but the four other metals will be expressed by the letters on the interior circle. If any one of the metals be taken away, the needle will not then take any of the above directions, but naturally point to the north; and its motion will be much slower. You therefore give the box to any one, and leave him at liberty to dispose all the tablets in what manner and with what side upward he please, and even to take any one of them away. Then, by the aid of your perspective, you tell him immediately the name of the metal on each tablet, and of that he has taken away.

This box of metals will, on comparison, be found far to exceed that which has been publicly exhibited: for that, being composed of six tablets, of which two only differ in form, admits but of six different dispositions, whereas in this the tablets may be placed 720 different ways. In the other, you must also know the particular side of the box, which in this is not at all necessary. Nay, you may here distinguish each metal, though the box be completely covered with paper; for the effect of the needle will be always the same. The experiments with this box are therefore much more extraordinary, and its construction at the same time more simple.

10. The magnetic planetarium.

CONSTRUCT a round box, ILMN, (fig. 38,) of eight or nine inches diameter, and half an inch deep. On its bottom fix a circle of pasteboard, on which draw the central circle A, and the seven circumjacent circles B, C, D, E, F, G, H. Divide the central circle into seven equal parts by the lines AB, AC, AD, AE, AF, AG, and AH, which must pass through the centres of the other circles, and divide each of them into two equal parts. Then divide the circumference of each of those circles into 14 equal parts, as in the figure. You are likewise to have another pasteboard of the same figure, and divided in the same manner,

which must turn freely in the box by means of an axis placed on a pivot; one end of which is to be fixed in the centre of the circle A. (See fig. 39.) On each of the seven smaller circles at the bottom of the box, place a magnetic bar, two inches long, in the same direction with the diameters of those circles, and their poles in the situations expressed in the figure. There must be an index O (fig. 39.), like that of the hour-hand of a dial, which is to be fixed on the axis of the central circle, and by which the pasteboard circle in the box may be turned about. There must be also a needle P, which must turn freely on the axis, without moving the circular pasteboard.—In each of the seven divisions of the central circle write a different question; and in another circle, divided into 12 parts, you may write the names of the 12 months. In each of the seven circles write two answers to each question, observing that there must be but seven words in each answer; in the following manner. In the first division of the circle G fig. 37. which is opposite to the first question, write the first word of the first answer. In the second division of the next circle, write the second word; and so on to the last word, which will be in the seventh division of the seventh circle. In the eighth division of the first circle, write the first word of the second answer; in the ninth division of the second circle, write the second word of the same answer; and so on to the 14th division of the seventh circle, which must contain the last word of that answer. The same must be done for all the seven questions; and to each of them must be assigned two answers, the words of which are to be dispersed through the seven circles. At the centre of each of these circles place a pivot; and have two magnetic needles, the pointed end of one of which must be north, and the other south, Q, R, (fig. 39.) Now, the index of the central circle being directed to any one of the questions, if you place one of the two magnetic needles on each of the seven lesser circles, they will fix themselves according to the direction of the bars on the correspondent circles at the bottom of the box, and consequently point to the seven words that compose the answer. If you place one of the other needles on each circle, it will point to the words that are diametrically opposite to those of the first answer, the north pole being in the place of the south pole of the other.—You therefore present this planetarium to any person, and desire him to choose one of the questions there wrote; and you then set the index of the central circle to that question, and putting one of the needles on each of the seven circles, you turn it about; and when they all settle, they will point to the seven words that compose the answer. The two answers may be one favourable and the other unfavourable; and the different needles will serve to diversify the answers when you repeat the experiment.

There may be also a moveable needle to place against the names of the months; and when the party has fixed upon a question, you place that needle against the month in which he was born, which will give the business an air of more mystery. On the centre of the large circle may be the figure of the sun; and on each of the seven smaller circles one of the characters of the five planets, together with the earth and moon. This

Entertain-
ing Experi-
ments.

experiment, well executed, is one of the most entertaining that magnetism has produced.

11. The sagacious swan.

Plate
ccclxxviii.
Fig. 40.

PROVIDE a box XY, 18 inches long, 9 wide, and 2 deep, the top of which is to slide on and off at the end Y. Toward the end X, describe a circle of six inches diameter, round which are to be fixed six small vases of wood or ivory, of one inch and a half high; and to each of them there must be a cover. At the end Y place an egg B, of ivory or other matter, of about three inches and a half high, with a cover that shuts by a hinge, and fastens with a spring. It must be fixed on the stand C; through which, as well as the bottom of the egg, and the part of the box directly underneath, there must pass a hole of one-third of an inch in diameter. In this cavity place an ivory cylinder F, that can move freely, and rises or falls by means of the spring R. You must have a thin copper basin A, of six inches diameter, which is to be placed on the centre of the circle at X, and consequently in the middle of the six vases. Let a proper workman construct the movement expressed by fig. 41. which is composed of a quadrant G, that has 16 teeth, and is moveable about an axis in the stand H, that has an elbow, by which it is screwed to the bottom of the box at L. To the quadrant there must be joined the straight piece K. The horizontal wheel M has 24 teeth; and is supported by the piece S, which is screwed to the end of the box next Y. On the axis of this wheel place a brass rod OP, five inches long; and at the part O place a large bar or horse-shoe, of a semi-circular form, and about two inches and a half diameter, strongly impregnated. The steel rod V, takes at one end the teeth of the quadrant G, by the pinion F, and at the other end the wheel M, by the perpendicular wheel N, of 30 teeth; the two ends of this rod are supported by the two stands that hold the other pieces. Under the piece K, that joins to the quadrant, must be placed the spring R, by which it is raised, and pushes up the cylinder that goes through the stand C into the egg. You must also have six small ewces or cases, as Y, Y, Y, Y, Y, Y. They must be of the same circumference with the cylinder in the stand, and round at their extremities: their length must be different, that, when they are placed in the egg, and the lower end enters the hole in which is the cylinder, they may thrust it down more or less, when the top of the egg, against which they press, is fastened down; and thereby lower the bar that is fixed to the end of the quadrant, and consequently, by means of the pinion Z and wheels NM turn the horse-shoe that is placed upon the axis of the last wheel. The exact length of these ewces can be determined by trials only; which trials, however, may be made with round pieces of wood. In each of these ewces place a different question, wrote on a slip of paper and rolled up, and in each of the vases put the answer to one of the questions; as you will know, by trials, where the magnetic bar or horse-shoe will stop. Lastly, provide a small figure of a swan, or what other you please, made of cork or enamel, in which you must fix a touched needle, of the largest size of those commonly used in sewing.

Nº 192.

Being thus prepared, you offer a person the fix ewces, and desire him to choose any one of them himself, and conceal the others, or give them to different persons. He is then to open his ewce, read the question it contains to himself, and return the ewce to you, after replacing the question. You then put the ewce in the egg, and placing the swan upon the water in the basin, you tell the company the will presently discover in which of the vases the answer is contained. The same experiment may be repeated with all the ewces.

12. The multifarious verse.

THE eight words that compose this Latin verse,
Tot sunt tibi dentes, quot cali sidera, virgo (A),
being privately placed in any one of the different combinations of which they are susceptible, and which are 40320 in number, to tell the order in which they are placed.

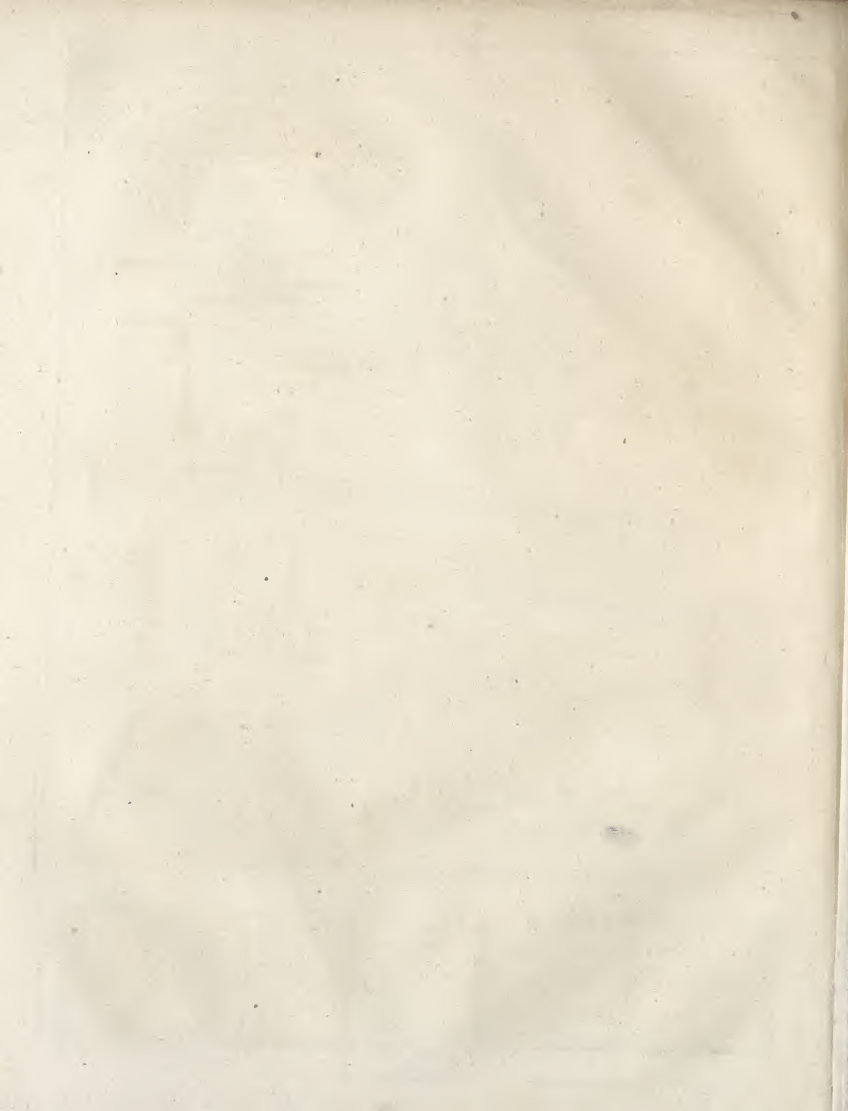
Provide a box that shuts with hinges, and is eight inches long, three wide, and half an inch deep. Have eight pieces of wood about one third of an inch thick, two inches long, and one and a half wide, which will therefore, when placed close together, exactly fill the box. In each of these pieces or tablets place a magnetic bar, with their poles as is expressed in the figure. The bars being covered over, write on each of the tablets, in the order they then stand, one of the words of the foregoing Latin verse. On a very thin board of the same dimensions with the box, draw the eight circles, A, B, C, D, E, F, G, H, (fig. 43.) whose centres should be exactly over those of the eight tablets in the box when the board is placed upon it. Divide each of those circles into eight parts, as in the figure; and in each of those divisions write one of the words of the Latin verse, and in the precise order expressed in the plate; so that, when the board is placed over the box, the eight touched needles placed at the centre of the circles may be regulated by the poles of the bars in the box, and consequently the word that the needle points to in the circle be the same with that inscribed on the tablet. Cover the board with a glass, to prevent the needles from rising off their pivots, as is done in the sea-compass. Over the board place four plates of glass, I, L, M, N, fig. 44. which will give the machine the figure of a truncated pyramid, of eight inches high. Cover it with a glass, or rather a board, in which are placed two lenses, O, O, of eight inches focus, and distant from each other about half an inch. Line the four plates of glass that compose the sides with very thin paper, that will admit the light, and at the same time prevent the company from seeing the circles on the board.

These preparations being made, you give the box to any one; and tell him to place the tablets on which the words are wrote, privately, in what position he thinks proper, then to close the box, and, if he please, to wrap it up in paper, seal it, and give it you. Then placing the board with the pyramid upon it, you immediately tell him the order in which the tablets are placed, by reading the words to which the needles on the circles point.

MAG.

(A) &c. Thy virtues, virgin, are as numerous as the stars of heaven.

Fig. 42.



Animal
Magnetism

Animal Magnetism, a sympathy lately supposed by some persons to exist between the magnet and the human body; by means of which the former became capable of curing many diseases in an unknown way, something resembling the performances of the old magicians.

The fanciful system, to call it by no worse name, of animal magnetism, appears to have originated, in 1774, from a German philosopher named *Father Hehl*, who greatly recommended the use of the magnet in medicine. *M. Mesmer*, a physician of the same country, by adopting the principles of *Hehl*, became the direct founder of the system; but, afterwards deviating from the tenets of his instructor, he lost his patronage, as well as that of *Dr Ingenhoufz*, which he had formerly enjoyed. *Mesmer* had already distinguished himself by "A dissertation on the influence of the Stars upon the human body," which he publicly defended in a thesis before the university of Vienna; but he was so unable to stand before the opposition of *Hehl* and *Ingenhoufz*, that his system fell almost instantly into disrepute. *Mesmer* appealed to the academy of sciences at Berlin; but they rejected his principles as destitute of foundation, and unworthy of the smallest attention. He then made a tour through Germany, publishing every where the great cures he performed by means of his animal magnetism, while his enemies every where pursued him with detections of the falsehood of his assertions.

Mesmer, still undaunted by so many defeats, returned to Vienna; but meeting there with no better success than before, he retired to Paris in the beginning of the year 1778. Here he met with a very different reception. He was first patronized by the author of the *Diéionnaire des Merveilles de la Nature*; in which work a great number of his cures were published, *Mesmer* himself receiving likewise an ample testimony of his candour and solid reasoning. Our physician soon collected some patients; and in the month of April 1778 retired with them to Creteil, from whence he in a short time returned with them perfectly cured. His success was now as great as his disappointment had been before. Patients increased so rapidly that the Doctor was soon obliged to take in pupils to assist him in his operations. These pupils succeeded equally well as *Mesmer* himself; and so well did they take care of their own emolument, that one of them, named *M. Deslon*, realized upwards of £. 100,000 Sterling. In 1779 *Mesmer* published a memoir on the subject of Animal Magnetism, promising afterwards a complete work upon the same, which should make as great a revolution in philosophy as it had already done in medicine.

The new system now gained ground daily; and soon became so fashionable, that the jealousy of the faculty was thoroughly awakened, and an application concerning it was made to government. In consequence of this a committee was appointed to inquire into the matter, consisting partly of physicians and partly of members of the royal academy of sciences, with *Dr Benjamin Franklin* at their head. This was a thunderstroke to the supporters of the new doctrine.—*Mesmer* himself refused to have any communication with the committee; but his most celebrated pupil

Deslon was less scrupulous, and explained the principles of his art in the following manner:

1. Animal magnetism is an universal fluid, constituting an absolute plenum in nature, and the medium of all mutual influence between the celestial bodies and betwixt the earth and animal bodies.

2. It is the most subtle fluid in nature; capable of a flux and reflux, and of receiving, propagating, and continuing all kinds of motion.

3. The animal body is subjected to the influences of this fluid by means of the nerves, which are immediately affected by it.

4. The human body has poles and other properties analogous to the magnet.

5. The action and virtue of animal magnetism may be communicated from one body to another, whether animate or inanimate.

6. It operates at a great distance without the intervention of any body.

7. It is increased and reflected by mirrors; communicated, propagated, and increased by sound; and may be accumulated, concentrated, and transported.

8. Notwithstanding the universality of this fluid, all animal bodies are not equally affected by it; on the other hand, there are some, though but few in number, the presence of which destroys all the effects of animal magnetism.

9. By means of this fluid nervous disorders are cured immediately, and others mediately; and its virtues, in short, extend to the universal cure and preservation of mankind.

From this extraordinary theory, *Mesmer*, or *M. Deslon*, had fabricated a paper, in which he stated that there was in nature but one disease and one cure, and that this cure was animal magnetism; and lastly, *M. Deslon* engaged, 1. To prove to the commissioners, that such a thing as animal magnetism existed; 2. To prove the utility of it in the cure of diseases; after which he was to communicate to them all that he knew upon the subject. The commissioners accordingly attended in the room where the patients underwent the magnetical operations. The apparatus consisted of a circular platform made of oak, and raised about a foot and an half from the ground; which platform was called the *baquet*. At the top of it were a number of holes, in which were iron rods with moveable joints for the purpose of applying them to any part of the body. The patients were placed in a circle round, each touching an iron rod, which he could apply to any part of the body at pleasure; they were joined to one another by a cord passing round their bodies, the design being to increase the effect by communication. In the corner of the room was a piano forte, on which some airs were played, occasionally accompanied with a song. Each of the patients held in his hand an iron rod ten or twelve feet long; the intention of which, as *Deslon* told the commissioners, was to concentrate the magnetism in its point, and thus to render its effects more sensible. Sound is another conductor of this magnetism; and in order to communicate the magnetism to the piano forte, nothing more is necessary than to bring the iron rod near it. Some magnetism is also furnished by the person who plays it; and this magnetism is transmitted

Animal
Magnetism

Animal
Magnetism

ted to the patients by the sounds. The internal part of the platform was said to be so contrived as to concentrate the magnetism, and was the reservoir whence the virtue diffused itself among the patients. Its structure, however, is not mentioned; but the committee satisfied themselves, by means of a needle and electrometer, that neither common magnetism nor electricity was concerned.

Besides the different ways of receiving the magnetism already mentioned, viz. by the iron, cord, and piano forte, the patients also had it directly from the Doctor's finger, and a rod which he held in his hand, and which he carried about the face, head, or such parts of the patient as were diseased; observing always the direction of what he called the poles. The principal application of magnetism, however, was by pressure of the hands or fingers on the hypochondria or lower regions of the stomach.

The effects of these operations upon Deslon's patients were very different. Some felt nothing, neither had the magnetism any effect whatever upon them. Some spit, coughed, sweat, and felt, or pretended to feel, extraordinary heats in different parts of the body. Many women, but very few men, had convulsions, which Deslon called their crisis, &c.—The commissioners at last found that they could come to no satisfactory conclusion while they attended in this public way, and therefore determined to try the experiments themselves privately. As the fluid itself, however, was totally imperceptible by any of the senses, they could only ascertain themselves of its existence by ultimately curing diseases, or by its observable effects upon the human body. Being well assured, however, that though many diseases were cured, it would not amount to any proof of the existence of animal magnetism, they determined to observe its effects on the animal economy. For this purpose they made the following experiments:

1. They tried it upon themselves, and felt nothing.

2. Seven of Deslon's patients were magnetised at Dr Franklin's house, four of whom felt nothing; three felt, or affected to feel something.

3. Several persons in a higher sphere of life were magnetised, and felt nothing.

4. The commissioners, now determined to discover what share imagination had in this business, blindfolded several of the common people, and made them sometimes think that they were magnetised, at other times they magnetised them without letting them know that they did so: the consequence was, that when they supposed themselves magnetised, the patients likewise thought they felt something, and *vice versa*.

5. A magnetised tree was said to produce convulsions; a young man, blindfolded, fell into convulsions when he imagined himself near the tree, though he was really at a considerable distance from it. Deslon accounted for this on the principle of all trees being magnetic: but in this case, every one, susceptible of magnetism, would be seized with convulsions when he approached a tree. The same influence of imagination was observed in a woman accustomed to have convulsions when magnetised. They came on when

nothing was done to her, on being told, when blindfolded, that she was magnetised.

Other instances are given, from which it was evident, either that the patients were impostors, or in such a most wretched state of debility both of mind and body, that the most trifling effects of the former had the most powerful effects on the latter. The commissioners therefore entirely disapproved of the whole. The touch, imitation, and imagination, they concluded, were the great causes of the effects produced by Mr Deslon's operations; and by means of these they supposed that convulsions, which in themselves are a very violent disorder, might be spread much farther than could be wished, even through a whole city. It was observed that the operator sometimes pressed strongly, and for a length of time, upon different parts of the body, particularly the hypochondria and pit of the stomach; and it is well known that a strong pressure on these parts will produce disagreeable sensations in those who enjoy perfect health.

It is needless to add more upon this subject, than that Mesmer complained of the report of the commissioners, petitioned parliament, was by them commanded to discover the mysteries of his doctrine; and that it is now exploded by every man of sense.—The conclusion of the academicians concerning it was, that it is not entirely useless even to philosophy; as it is one *fiat* more to be confined to the history of the errors and illusions of the human mind, and a signal instance of the power of imagination.

MAGNIEZ (Nicolas), a learned and laborious ecclesiastic, who died in the year 1749 at an advanced age. He is known by his excellent Latin dictionary, intitled *Novitius*, printed at Paris 1721, 2 vols 4to. Notwithstanding the great utility of this dictionary to masters, and the merited esteem in which it is held, it has never undergone another edition; for in that which bears the date of 1733, there is no circumstance of difference except the frontispiece. In this dictionary, besides the words to be met with in the classics, we find all those which occur in the Bible, the breviary, and the ecclesiastical authors, the terms of art, the names of great men, heathen gods, bishops, councils, heresies, &c.; in short, more than 6000 words which are not to be found in the common dictionaries.

MAGNIFYING, the making of objects appear larger than they would otherwise do; whence convex lenses, which have the power of doing this, are called *magnifying glasses*. See OPTICS.

MAGNITUDE, whatever is made up of parts locally extended, or that has several dimensions; as a line, surface, solid, &c.

MAGNOLIA, the LAUREL-LEAVED TULIP TREE, in botany: A genus of the polyginia order, belonging to the polyandria class of plants; and in the natural method ranking under the 32d order, *Coadunate*. The calyx is triphyllous; there are nine petals; the capsules bivalved and imbricated; the seeds pendulous, and in the form of a berry.

Species. 1. The glauca, or small magnolia, is a native of Virginia, Carolina, and other parts of North America. In moist places it rises from seven or eight to 15 or 16 feet high, with a slender stem. The

wood

Animal
Magnetism
||
Magnolia.

Magnolia. wood is white and spongy, the bark smooth and of a greenish white colour; the branches garnished with thick smooth leaves, like those of the bay; but of an oval shape, smooth on their edges, and white underneath. The flowers are produced at the extremities of the branches, are white, composed of six concave petals, and have an agreeable scent. After the flowers are past, the fruit increases in size till it becomes as large as a walnut with its cover; but of a conical shape, having many cells round the outside, in each of which is a flat seed about the size of a small kidney-bean. When ripe, the fruit is of a brown colour, the seeds are discharged from their cells, and hang by a slender thread. 2. The grandiflora, or great magnolia, is a native of Florida and South Carolina. It rises to the height of 80 feet or more, with a straight trunk upwards of two feet diameter, having a regular lead. The leaves resemble those of the laurel, but are larger, and continue green throughout the year. The flowers are produced at the ends of the branches, and are of a purplish white colour. 3. The tripetala, or umbrellatree, is a native of Carolina. It rises, with a slender trunk, to the height of 16 or 20 feet; the wood is soft and spongy; the leaves remarkably large, and produced in horizontal circles, somewhat resembling an umbrella, from whence the inhabitants of those countries have given it this name. The flowers are composed of ten or eleven white petals, that hang down without any order. The leaves drop off at the beginning of winter. 4. The acuminata, with oval, spear-shaped, pointed leaves, is a native of the inland parts of North America. The leaves are near eight inches long, and five broad; ending in a point. The flowers come out early in the spring, and are composed of 12 white petals; the wood is of a fine grain, and an orange colour.

Culture, &c. All these species are propagated by seeds, which must be procured from the places where they grow naturally. They should be put up in sand, and sent over as soon as possible; for if they are kept long out of the ground, they rarely grow.—The glauca generally grows in a poor swampy soil, or on wet meadows. The English and Swedes in Pennsylvania and New Jersey call it *beaver-tree*, because the root of it is the dainty of beavers, which are caught by its means. It drops its leaves early in autumn, though some of the young trees keep them all the winter. This tree is seldom found to the north of Pennsylvania, where it begins to flower about the end of May. The scent of its blossoms is exquisite: for by it you can discover, within three quarters of an English mile, whether these little trees stand in the neighbourhood, provided the wind be not against it; for the whole air is filled with this sweet and pleasant odour. It is beyond description agreeable to travel in the woods about that time, especially towards night. They retain their flowers for three weeks, and even longer, according to the quality of the soil on which the trees stand; and during the whole time of their being in blossom, they spread their odiferous exhalations. The berries likewise look very fine when they are ripe; for they have a rich red colour, and hang in bunches on slender stalks. The cough and other pectoral diseases are cured by putting the berries into run or brandy, of which a draught every morning may be taken; the

virtues of this remedy were universally extolled, and even praised, for their salutary effects in consumptions. The bark being put into brandy, or boiled in any other liquor, is said not only to ease pectoral diseases, but likewise to be of some service against all internal pains and heat; and it was thought that a decoction of it could stop the dysentery. Persons who had caught cold boiled the branches of the beaver-tree in water, and drank it to their great relief. *Kalm.*

MAGNUS (John), archbishop of Upsal, was born at Lincopping in 1438. Being made apostolical nuncio, he used his utmost endeavours to prevent Gustavus Vasa from becoming king of Sweden, and the introduction of Lutheranism into his dominions; and spared no means to attain these ends. He died at Rome in 1545. He wrote a history of Sweden, and a history of the archbishops and bishops of Upsal.

MAGNUS (Olaus), archbishop of Upsal in Sweden, succeeded his brother John Magnus in 1544. He appeared with great credit at the council of Trent in 1546, and suffered much afterward for the Catholic religion. We have of his writing, *A History of the Manners, Customs, and Wars of the Northern Nations of Europe.*

MAGNUS CAMPUS, (anc. geog.), a tract lying towards Scythopolis, or Bethsan in Galilee, beyond which it extends into Samaria; Josephus placing the common boundary between these two districts, in the Campus Magnus. Called also *Ejdelon*, (Judith); 30 miles long, and 18 broad; having Samaria with mount Ephraim to the south, the lake Genesareth to the east; mount Carmel to the west, and Lebanon to the north.

MAGNUS PORTUS, (anc. geog.), a port of the Belge, in Britain, on the Channel. Now thought to be Portsmouth, in Hampshire.—Another *Portus Magnus* of Bætica in Spain; a port to the east of Abdera.

MAGO, the name of several Carthaginian generals. See *CARTHAGE*.

MAGO, (anc. geog.) a citadel and town of the Balaaris Minor, or Minorca. Now Maon, or Mahon. E. long. 4° 6'. lat. 39° 5'.

MAGONTIACUM, **MOGONTIACUM**, or *Mogontiacus*, truncated afterwards by the poets to *Montania*, *Maguntia*, and *Moguntia*: a town of Gallia Belgica. Now *Mentz*, capital of the electorate of that name; situated at the confluence of the Rhine and Maine. E. long. 8°, lat. 50°.

MAGOPHONIA (formed from $\mu\alpha\gamma\alpha$, "magus," and $\phi\omega\gamma\eta$, "slaughter"), the name of a feast among the ancient Persians, held in memory of the expulsion of the Magians. The Magus Smerdis having usurped the throne of Persia, upon the death of Cambyles, 521 years before Jesus Christ, seven of the principal lords of the court conspired to drive him out of it.—Their design was executed with good success: Smerdis and his brother, another Magus, called Patizithes, were killed. Upon which the people also rose, and put all the Magi to the sword, inasmuch that there would not one have escaped, had not night come upon them. Darius, son of Hytaspes, was then elected king; and, in memory of this massacre of the Magi, a feast was instituted, says Herodotus, called *Magophonia*. See *MAGI*.

MAGPY, in ornithology. See *CORVUS*.

Magnus
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Magpy.

Mahie
||
Mahomet.

MAHIE, the name given by the inhabitants of O-taheite, or George's island, to their bread-fruit when made into a kind of four paste, which, in consequence of having undergone a fermentation, will keep a considerable time, and supply them with food when no ripe fruit is to be had. When therefore they see a great shew of new fruit on the trees, they strip them all at once of their former crop, of which they make mahie. This *succedaneum* for ripe bread-fruit is thus made. They gather the fruit before it be perfectly ripe, and laying it in heaps cover it closely with leaves. In this state it ferments, and becomes disagreeably sweet; the core is then taken out entire, and the rest of the fruit thrown into a hole in their houses, dug on purpose, and neatly lined in the bottom and sides with grass. The whole is then covered with leaves, and heavy stones are laid upon them. In this state it undergoes a second fermentation, and becomes four; after which it will suffer no change for many months. It is taken out of this hole as it is wanted for use, and being made into balls, it is wrapped up in leaves and baked, and thus dressed it will keep for five or six weeks. It is eaten, both cold and hot, and the natives of those countries seldom make a meal without it; but to captain Cook and his company the taste was as disagreeable as that of a pickled olive generally is the first time it is eaten.

MAHO. See HIBISCUS.

MAHOGANY. See SWIETENIA.

MAHOMET, or MOHAMMED, styled the *Impostor*, was born in the reign of Anushirwan the Just, emperor of Persia, about the end of the 6th century of the Christian era. He came into the world under some disadvantages. His father Abd'allah was a younger son of Abd'almotaleb; and dying very young, and in his father's lifetime, left his widow and infant-son in very mean circumstances, his whole substance consisting but of five camels and one Ethiopian slave. Abd'almotaleb was therefore obliged to take care of his grandchild Mahomet; which he not only did during his life, but at his death enjoined his eldest son Abu Taleb, who was brother to Abd'allah by the same mother, to provide for him for the future: which he very affectionately did, and instructed him in the business of a merchant, which he followed; and to that end he took him into Syria when he was but 13. He afterwards recommended him to Khadijah, a noble and rich widow, for her factor; in whose service he behaved himself so well, that by making him her husband she soon raised him to an equality with the richest in Mecca.

After he began by this advantageous match to live at his ease, it was, that he formed the scheme of establishing a new religion, or, as he expressed it, of replanting the only true and ancient one professed by Adam, Noah, Abraham, Moses, Jesus, and all the prophets, by destroying the gross idolatry into which the generality of his countrymen had fallen, and weeding out the corruptions and superstitions which the latter Jews and Christians had, as he thought, introduced into their religion, and reducing it to its original purity, which consisted chiefly in the worship of one only God.

Before he made any attempt abroad, he rightly judged that it was necessary for him to begin with the

conversion of his own household. Having therefore retired with his family, as he had done several times before, to a cave in mount Hara, he there opened the secret of his mission to his wife Khadijah; and acquainted her, that the angel Gabriel had just before appeared to him, and told him that he was appointed the apostle of God; he also repeated to her a passage which he pretended had been revealed to him by the ministry of the angel, with those other circumstances of this first appearance, which are related by the Mahometan writers. Khadijah received the news with great joy; swearing by him in whose hands her soul was, that the trusted he would be the prophet of his nation; and immediately communicated what she had heard to her cousin Warakah Ebn Nawfal, who, being a Christian, could write in the Hebrew character, and was tolerably well versed in the scriptures; and he as readily came into her opinion, assuring her that the same angel who had formerly appeared unto Moses was now sent to Mahomet. The first overture the prophet made was in the month of Ramadan, in the 40th year of his age, which is therefore usually called the year of his mission.

Encouraged by so good a beginning, he resolved to proceed, and try for some time what he could do by private persuasion, not daring to hazard the whole affair by exposing it too suddenly to the public. He soon made proselytes of those under his own roof, viz. his wife Khadijah, his servant Zeid Ebn Haretha, to whom he gave his freedom on that occasion, (which afterwards became a rule to his followers), and his cousin and pupil Ali, the son of Abu Taleb, though then very young: but this last, making no account of the other two, used to style himself the *first of believers*. The next person Mahomet applied to was Abd'allah Ebn Abi Kohafa, surnamed *Abu Beer*, a man of great authority among the Koreish, and one whose interest he well knew would be of great service to him; as it soon appeared: for Abu Beer, being gained over, prevailed also on Othman Ebn Affan, Abd'alrahman Ebn Awf, Saad Ebn Abbi Wakkas, al Zobeir Ebn al A-wam, and Telha Ebn Obeid'allah, all principal men of Mecca, to follow his example. These men were the six chief companions, who, with a few more, were converted in the space of three years: at the end of which, Mahomet having, as he hoped, a sufficient interest to support him, made his mission no longer a secret, but gave out that God had commanded him to admonish his near relations; and in order to do it with more convenience and prospect of success, he directed Ali to prepare an entertainment, and invite the sons and descendants of Abd'almotaleb, intending then to open his mind to them. This was done, and about 40 of them came; but Abu Laheh, one of his uncles, making the company break up before Mahomet had an opportunity of speaking, obliged him to give them a second invitation the next day; and when they were come, he made them the following speech: "I know no man in all Arabia who can offer his kindred a more excellent thing than I now do you: I offer you happiness both in this life, and in that which is to come; God Almighty hath commanded me to call you unto him: Who, therefore, among you will be assistant to me herein, and become my brother and my vicegerent?" All of them hesitating, and declining the matter, Ali

Mahomet. at length rose up, and declared that he would be his assailant; and vehemently threatened those who should oppose him. Mahomet upon this embraced Ali with great demonstrations of affection, and desired all who were present to hearken to and obey him as his deputy; at which the company broke out into a great laughter, telling Abu Taleb that he must now pay obedience to his son.

This repulse, however, was so far from discouraging Mahomet, that he began to preach in public to the people; who heard him with some patience till he came to upbraid them with the idolatry, obliquity, and perverseness of themselves and their fathers: which so highly provoked them, that they declared themselves his enemies; and would soon have procured his ruin, had he not been protected by Abu Taleb. The chief of the Koreish warmly solicited this person to desert his nephew, making frequent remonstrances against the innovations he was attempting; which proving ineffectual, they at length threatened him with an open rupture, if he did not prevail on Mahomet to desist. At this Abu Taleb was so far moved, that he earnestly dissuaded his nephew from pursuing the affair any farther, representing the great danger he and his friends must otherwise run. But Mahomet was not to be intimidated; telling his uncle plainly, *that if they set the sun against him on his right hand, and the moon on his left, he would not leave his enterprise*: and Abu Taleb, seeing him so firmly resolved to proceed, used no further arguments, but promised to stand by him against all his enemies.

The Koreish, finding they could prevail neither by fair words or menaces, tried what they could do by force and ill-treatment; using Mahomet's followers so very injuriously, that it was not safe for them to continue at Mecca any longer: whereupon Mahomet gave leave to such of them as had not friends to protect them to seek for refuge elsewhere. And accordingly in the fifth year of the prophet's mission, 16 of them, four of whom were women, fled into Ethiopia; and among them Othman Ebn Affan and his wife Rakiyah, Mahomet's daughter. This was the first flight; but afterwards several others followed them, retiring one after another, to the number of 83 men and 18 women, besides children. These refugees were kindly received by the Najashi, or king of Ethiopia; who refused to deliver them up to those whom the Koreish sent to demand them, and, as the Arab writer unanimously attest, even professed the Mahometan religion.

In the sixth year of his mission, Mahomet had the pleasure of seeing his party strengthened by the conversion of his uncle Hamza, a man of great valour and merit; and of Omar Ebn al Kattab, a person highly esteemed, and once a violent opposer of the prophet. As persecution generally advances rather than obstructs the spreading of a religion, Islamism made so great a progress among the Arab tribes, that the Koreish, to suppress it effectually if possible, in the seventh year of Mahomet's mission, made a solemn league or covenant against the Hahemites and the family of Abd'almotaleb, engaging themselves to contract no marriages with any of them, and to have no communication with them; and, to give it the greater sanction, reduced it into writing, and laid it up in the Caaba. Upon this

the tribe became divided into two factions; and the family of Hahem all repaired to Abu Taleb, as their head; except only Abd'al Uzza, surnamed *Abu Lahab*, who, out of inveterate hatred to his nephew and his doctrine, went over to the opposite party, whose chief was Abu Sofian Ebn Harb, of the family of Ommeyya.

The families continued thus at variance for three years; but in the tenth year of his mission, Mahomet told his uncle Abu Taleb, that God had manifestly showed his disapprobation of the league which the Koreish had made against them, by sending a worm to eat out every word of the instrument except the name of *God*. Of this accident Mahomet had probably some private notice: for Abu Taleb went immediately to the Koreish, and acquainted them with it; offering, if it proved false, to deliver his nephew up to them; but in case it were true, he insisted that they ought to lay aside their animosity, and annul the league they had made against the Hahemites. To this they acquiesced; and going to inspect the writing, to their great astonishment found it to be as Abu Taleb had said; and the league was thereupon declared void.

In the same year Abu Taleb died, at the age of above fourscore; and it is the general opinion that he died an infidel: though others say, that when he was at the point of death he embraced Mahometanism; and produce some passages out of his poetical compositions to confirm their assertion. About a month, or, as some write, three days after the death of this great benefactor and patron, Mahomet had the additional mortification to lose his wife Khadijah, who had so generously made his fortune. For which reason this year is called the year of mourning.

On the death of these two persons, the Koreish began to be more troublesome than ever to their prophet, and especially some who had formerly been his intimate friends; inasmuch that he found himself obliged to seek for shelter elsewhere, and first pitched upon Tayef, about 60 miles east from Mecca, for the place of his retreat. Thither therefore he went, accompanied by his servant Zied, and applied himself to two of the chief of the tribe of Thakif who were the inhabitants of that place; but they received him very coldly. However, he staid there a month; and some of the more considerate and better sort of men treated him with a little respect: but the slaves and inferior people at length rose against him; and bringing him to the wall of the city, obliged him to depart and return to Mecca, where he put himself under the protection of Al Motaam Ebn Adi.

This repulse greatly discouraged his followers. However, Mahomet was not wanting to himself; but boldly continued to preach to the public assemblies at the pilgrimage, and gained several proselytes; and among them six of the inhabitants of Yathreb of the Jewish tribe of Khazraj; who, on their return home, failed not to speak much in commendation of their new religion, and exhorted their fellow-citizens to embrace the same.

In the 12th year of his mission it was that Mahomet gave out that he had made his night-journey from Mecca to Jerusalem, and thence to heaven, so much spoken of by all that write of him. Dr Prideaux thinks he invented it, either to answer the expectations

Mahomet. of those who demanded some miracle as a proof of his mission; or else, by pretending to have conferred with God, to establish the authority of whatever he should think fit to leave behind by way of oral tradition, and make his sayings to serve the same purpose as the oral law of the Jews. But it does not appear that Mahomet himself ever expected for great a regard should be paid to his sayings, as his followers have since done; and seeing he all along disclaimed any power of performing miracles, it seems rather to have been a fetch of policy to raise his reputation, by pretending to have actually conferred with God in heaven, as Moses had heretofore done in the mount, and to have received several institutions immediately from him, whereas before he contented himself with persuading them that he had all by the ministry of Gabriel.

However, this story seemed absurd and incredible, that several of his followers left him upon it; and had probably ruined the whole design, had not Abu Beer vouched for his veracity, and declared, that, if Mahomet affirmed it to be true, he verily believed the whole. Which happy incident not only retrieved the prophet's credit, but increased it to such a degree, that he was secure of being able to make his disciples swallow whatever he pleased to impose on them for the future. And this fiction, notwithstanding its extravagance, was one of the most artful contrivances Mahomet ever put in practice, and what chiefly contributed to the raising of his reputation to that great height to which it afterwards arrived.

In this year, called by the Mahometans the *accepted year*, 12 men of Yathreb or Medina, of whom 10 were of the tribe of Khazraj and the other two of that of Aws, came to Mecca, and took an oath of fidelity to Mahomet at al Akaba, a hill on the north of that city. This oath was called the *women's oath*; not that any women were present at this time, but because a man was not thereby obliged to take up arms in defence of Mahomet or his religion; it being the same oath that was afterwards exacted of the women, the form of which we have in the Koran, and is to this effect: *viz.* That they should renounce all idolatry; and they should not steal, nor commit fornication, nor kill their children (as the Pagan Arabs used to do when they apprehended they should not be able to maintain them), nor forge calumnies; and that they should obey the prophet in all things that were reasonable. When they had solemnly engaged to all this, Mahomet sent one of his disciples, named *Masab Ebn Omair*, home with them, to instruct them more fully in the grounds and ceremonies of his new religion.

Masab being arrived at Medina, by the assistance of those who had been formerly converted, gained several proselytes, particularly *Osaid Ebn Hodeira*, a chief man of the city, and *Saad Ebn Moadh*, prince of the tribe of Aws; Mahometanism spreading so fast, that there was scarce a house wherein there were not some who had embraced it.

The next year, being the 13th of Mahomet's mission, Masab returned to Mecca, accompanied by 73 men and two women of Medina who had professed Islamism, besides some others who were as yet unbelievers. On their arrival, they immediately sent to Mahomet, and offered him their assistance, of which he was now

in great need; for his adversaries were by this time grown so powerful in Mecca, that he could not stay there much longer without imminent danger. Wherefore he accepted their proposal, and met them one night, by appointment, at al Akaba above mentioned, attended by his uncle al Abbas; who, though he was not then a believer, wished his nephew well, and made a speech to those of Medina; wherein he told them, that as Mahomet was obliged to quit his native city, and seek an asylum elsewhere, and they had offered him their protection, they would do well not to deceive him; that if they were not firmly resolved to defend, and not betray him, they had better declare their minds, and let him provide for his safety in some other manner. Upon their protesting their sincerity, Mahomet swore to be faithful to them, on condition that they should protect him against all insults as heartily as they would their own wives and families. They then asked him what recompence they were to expect if they should happen to be killed in his quarrel; he answered, Paradise. Whereupon they pledged their faith to him, and so returned home; after Mahomet had chosen 12 out of their number, who were to have the same authority among them as the 12 apostles of Christ had among his disciples.

Hitherto Mahomet had propagated his religion by fair means; so that the whole success of his enterprise, before his flight to Medina, must be attributed to persuasion only, and not to compulsion. For before this second oath of fealty or inauguration at al Akaba, he had no permission to use any force at all; and in several places of the Koran, which he pretended were revealed during his stay at Mecca, he declares his business was only to preach and admonish; that he had no authority to compel any person to embrace his religion; and that, whether people believe or not, was none of his concern, but belonged solely unto God. And he was so far from allowing his followers to use force, that he exhorted them to bear patiently those injuries which were offered them on account of their faith; and, when persecuted himself, chose rather to quit the place of his birth and retire to Medina, than to make any resistance. But this great passiveness and moderation seem entirely owing to his want of power, and the great superiority of his opposers for the first 12 years of his mission; for no sooner was he enabled, by the assistance of those of Medina, to make head against his enemies, than he gave out, that God had allowed him and his followers to defend themselves against the infidels; and at length, as his forces increased, he pretended to have the divine leave even to attack them; and to destroy idolatry, and set up the true faith by the sword; finding, by experience, that his designs would otherwise proceed very slowly, if they were not utterly overthrown; and knowing, on the other hand, that innovators, when they depend solely on their own strength, and can compel, seldom run any risk; from whence, says Machiavel, it follows, that all the armed prophets have succeeded, and the unarmed ones have failed. Moses, Cyrus, Theseus, and Romulus, would not have been able to establish the observance of their institutions for any length of time, had they not been armed. The first passage of the Koran which gave Mahomet the permission of defend-

Mahomet. ing himself by arms, is said to have been that in the 22d chapter; after which a great number to the same purpose were revealed.

That Mahomet had a right to take up arms for his own defence against his unjust persecutors, may perhaps be allowed; but whether he ought afterwards to have made use of that means for the establishing of his religion, it is not so easy to determine. How far the secular power may or ought to interpose in affairs of this nature, mankind are not agreed. The method of converting by the sword gives no very favourable idea of the faith which is so propagated, and is disallowed by every body in those of another religion, though the same persons are willing to admit of it for the advancement of their own; supposing that, though a false religion ought not to be established by authority, yet a true one may; and accordingly force is almost as constantly employed in these cases by those who have the power in their hands, as it is constantly complained of by those who suffer the violence. It is certainly one of the most convincing proofs that Mahometanism was no other than a human invention, that it owed its progress and establishment almost entirely to the sword; and it is one of the strongest demonstrations of the divine original of Christianity, that it prevailed against all the force and powers of the world by the mere dint of its own truth, after having stood the assaults of all manner of persecutions, as well as other oppositions, for 300 years together, and at length made the Roman emperors themselves submit thereto; after which time, indeed, this proof seems to fail, Christianity being then established, and Paganism abolished, by public authority, which has had great influence in the propagation of the one and destruction of the other ever since. But to return.

Mahomet, having provided for the security of his companions as well as his own, by the league offensive and defensive which he had now concluded with those of Medina, directed them to repair thither, which they accordingly did; but himself with Abu Beer and Ali staid behind, having not yet received the divine permission, as he pretended, to leave Mecca. The Koreish fearing the consequence of this new alliance, began to think it absolutely necessary, to prevent Mahomet's escape to Medina; and having held a council thereon, after several milder expedients had been rejected, they came to a resolution that he should be killed; and agreed that a man should be chosen out of every tribe for the execution of this design; and that each man should have a blow at him with his sword, that the guilt of his blood might fall equally on all the tribes, to whose united power the Hashemites were much inferior, and therefore durst not attempt to revenge their kinsman's death.

This conspiracy was scarce formed, when, by some means or other, it came to Mahomet's knowledge; and he gave out that it was revealed to him by the angel Gabriel, who had now ordered him to retire to Medina. Whereupon, to amuse his enemies, he directed Ali to lie down in his place, and wrap himself up in his green cloak, which he did; and Mahomet escaped miraculously, as they pretend, to Abu Beer's house, unperceived by the conspirators, who had already assembled at the prophet's door. They, in the mean time, looking through the crevice, and seeing Ali,

whom they took to be Mahomet himself, asleep, continued watching there till morning, when Ali awoke, and they found themselves deceived.

From Abu Beer's house Mahomet and he went to a cave in mount Thaur, to the south-east of Mecca, accompanied only by Amer Ebn Foheirah, Abu Beer's servant, and Abd'allah Ebn Oreitah, an idolater whom they had hired for a guide. In this cave they lay hid three days, to avoid the search of their enemies; which they very narrowly escaped, and not without the assistance of more miracles than one: for some say that the Koreish were struck with blindness, so that they could not find the cave; others, that after Mahomet and his companions were got in, two pigeons laid their eggs at the entrance, and a spider covered the mouth of the cave with her web, which made them look no farther. Abu Beer, seeing the prophet in such imminent danger, became very sorrowful; whereupon Mahomet comforted him with these words, recorded in the Koran, *Be not grieved, for God is with us*. Their enemies being retired, they left the cave, and set out for Medina, by a by-road; and having fortunately, or, as the Mahometans tell us, miraculously escaped some who were sent to pursue them, arrived safely at that city; whither Ali followed them in three days, after he had settled some affairs at Mecca.

The first thing Mahomet did after his arrival at Medina, was to build a temple for his religious worship, and a house for himself, which he did on a parcel of ground which had before served to put camels in, or, as others tell us, for a burying-ground, and belonged to Sahal and Soheil the sons of Amru, who were orphans. This action Dr Prideaux exclaims against, representing it as a flagrant instance of injustice; for that, says he, he violently dispossessed these poor orphans, the sons of an inferior artificer (whom the author he quotes calls a *carpenter*), of this ground, and so founded the first fabric of his worship with the like wickedness as he did his religion. But, to say nothing of the improbability that Mahomet should act in so impolitic a manner at his first coming, the Mahometan writers set this affair in a quite different light: one tells us that he treated with the lads about the price of the ground, but they desired he would accept it as a present: however, as historians of good credit assure us, he actually bought it; and the money was paid by Abu Beer. Besides, had Mahomet accepted it as a present, the orphans were in circumstances sufficient to have afforded it: for they were of a very good family, of the tribe of Najjer, one of the most illustrious among the Arabs; and not the sons of a carpenter, as Dr Prideaux's author writes, who took the word *Najjer*, which signifies "a carpenter," for an appellation; whereas it is a proper name.

Mahomet, being securely settled at Medina, and able not only to defend himself against the insults of his enemies, but to attack them, began to send out small parties to make reprisals on the Koreish; the first party consisting of no more than nine men, who intercepted and plundered a caravan belonging to that tribe, and in the action took two prisoners. But what established his affairs very much, and was the foundation on which he built all his succeeding greatness,

Mahomet.

Mahomet was the gaining of the battle of Bedr, which was fought in the second year of the Hegira, and is so famous in the Mahometan history. Some reckon no less than 27 expeditions wherein Mahomet was personally present, in nine of which he gave battle, besides several other expeditions in which he was not present. His forces he maintained partly by the contributions of his followers for this purpose, which he called by the name of *zaco* or *alms*, and the paying of which he very artfully made one main article of his religion; and partly by ordering a fifth part of the plunder to be brought into the public treasury for that purpose, in which matter he likewise pretended to act by the divine direction.

In a few years, by the success of his arms (notwithstanding he sometimes came off by the worst) he considerably raised his credit and power. In the sixth year of the Hegira he set out with 1400 men to visit the temple of Mecca, not with any intent of committing hostilities, but in a peaceable manner. However, when he came to al Hodeibiya, which is situated partly within and partly without the sacred territory, the Koreish sent to let him know that they would not permit him to enter Mecca, unless he forced his way; whereupon he called his troops about him, and they all took a solemn oath of fealty or homage to him, and he resolved to attack the city; but those of Mecca sending Arwa Ebn Masud, prince of the tribe of Thakif, as their ambassador, to desire peace, a truce was concluded between them for ten years, by which any person was allowed to enter into league either with Mahomet, or with the Koreish, as he thought fit.

It may not be improper, in order to show the inconceivable veneration and respect the Mahometans by this time had for their prophet, to mention the account which the above-mentioned ambassador gave the Koreish, at his return, of their behaviour. He said he had been at the courts both of the Roman emperor and of the king of Persia, and never saw any prince so highly respected by his subjects as Mahomet was by his companions: for, whenever he made the ablution, in order to say his prayers, they ran and caught the water that he had used; and, whenever he spit, they immediately licked it up, and gathered every hair that fell from him with great superstition.

In the seventh year of the Hegira, Mahomet began to think of propagating his religion beyond the bounds of Arabia; and sent messengers to the neighbouring princes, with letters to invite them to Mahometism. Nor was this project without some success. Khofru Parviz, then king of Persia, received his letter with great disdain, and tore it in a passion, sending away the messenger very abruptly; which when Mahomet heard, he said *God shall tear his kingdom*. And soon after a messenger came to Mahomet from Badhan king of Yaman, who was a dependent on the Persians, to acquaint him that he had received orders to send him to Khofru. Mahomet put off his answer till the next morning, and then told the messenger it had been revealed to him that night that Khofru was slain by his son Shiruyeh; adding, that he was well assured his new religion and empire should rise to as great a height as that of Khofru; and therefore bid

him advise his master to embrace Mahometism. The messenger being returned, Badhan in a few days received a letter from Shiruyeh, informing him of his father's death, and ordering him to give the prophet no further disturbance. Whereupon Badhan and the Persians with him turned Mahometans.

The emperor Heraclius, as the Arabian historians assure us, received Mahomet's letter with great respect, laying it on his pillow, and dismissed the bearer honourably. And some pretend that he would have professed this new faith, had he not been afraid of losing his crown.

Mahomet wrote to the same effect to the king of Ethiopia, though he had been converted before, according to the Arab writers; and to Mokawkas, governor of Egypt, who gave the messenger a very favourable reception, and sent several valuable presents to Mahomet, and among the rest two girls, one of which, named Mary, became a great favourite with him. He also sent letters of the like purport to several Arab princes: particularly one to al Hareth Ebn Abi Shamer king of Ghassan, who returning for answer that he would go to Mahomet himself, the prophet said, *May his kingdom perish*: another to Hawdha Ebn Ali, king of Yamama, who was a Christian, and, having some time before professed Islamism, had lately returned to his former faith; this prince sent back a very rough answer, upon which Mahomet cursing him, he died soon after: and a third to al Mondar Ebn Sawa, king of Bahrein, who embraced Mahometism, and all the Arabs of that country followed his example.

The eighth year of the Hegira was a very fortunate year to Mahomet. In the beginning of it, Khalid Ebn al Walid and Amru Ebn al As, both excellent soldiers, the first of whom afterwards conquered Syria and other countries, and the latter Egypt, became proselytes to Mahometism. And soon after the prophet sent 3000 men against the Grecian forces, to revenge the death of one of his ambassadors, who, being sent to the governor of Bosra on the same errand as those who went to the abovementioned princes, were slain by an Arab, of the tribe of Ghassan, at Muta, a town in the territory of Balka in Syria, about three days journey eastward from Jerusalem, near which town they encountered. The Grecians being vastly superior in number (for, including the auxiliary Arabs, they had an army of 100,000 men), the Mahometans were repulsed in the first attack, and lost successively three of their generals, viz. Zeid Ebn Haretha Mahomet's freedman, Jaafar the son of Abu Taleb, and Abdallah Ebn Rawaha: but Khaleb Ebn al Walid succeeding to the command, overthrew the Greeks with a great slaughter, and brought away abundance of rich spoil; on occasion of which action Mahomet gave him the title of *Seif min يوسف Allah*, "one of the swords of God."

In this year also Mahomet took the city of Mecca, the inhabitants whereof had broken the truce concluded on two years before. For the tribe of Beer, who were confederates with the Koreish, attacking those of Khozaah, who were allies of Mahomet, killed several of them, being supported in the action by a party of the Koreish themselves. The consequence

Mahomet

of this violation was soon apprehended; and Abu Sofian himself made a journey to Medina on purpose to heal the breach and renew the truce: but in vain; for Mahomet, glad of this opportunity, refused to see him: whereupon he applied to Abu Beer and Ali; but they giving him no answer, he was obliged to return to Mecca as he came.

Mahomet immediately gave orders for preparations to be made, that he might surprize the Meccans while they were unprovided to receive him: in a little time he began his march thither; and by that time he came near the city, his forces were increased to 10,000 men. Those of Mecca, being not in a condition to defend themselves against so formidable an army, surrendered at discretion; and Abu Sofian saved his life by turning Mahometan. About 28 of the idolaters were killed by a party under the command of Khaled; but this happened contrary to Mahomet's orders, who, when he entered the town, pardoned all the Koreish on their submission, except only six men and four women, who were more obnoxious than ordinary (some of them having apostatised), and were solemnly proscribed by the prophet himself; but of these no more than three men and one woman were put to death, the rest obtaining pardon on their embracing Mahometism, and one of the women making her escape.

The remainder of this year Mahomet employed in destroying the idols in and round Mecca, sending several of his generals on expeditions for that purpose, and to invite the Arabs to Islamism: wherein it is no wonder if they now met with success.

The next year, being the ninth of the Hegira, the Mahometans call the *year of embassies*: for the Arabs had been hitherto expecting the issue of the war between Mahomet and the Koreish: but, so soon as that tribe, the principal of the whole nation, and the genuine descendants of Ishmael, whose prerogatives none offered to dispute, had submitted, they were satisfied that it was not in their power to oppose Mahomet; and therefore began to come in to him in great numbers, and to send embassies to make their submissions to him, both to Mecca, while he staid there, and also to Medina, whither he returned this year. Among the rest, five kings of the tribe of Hamyar professed Mahometism, and sent ambassadors to notify the same.

In the 10th year, Ali was sent into Yaman to propagate the Mahometan faith there; and, as it is said, converted the whole tribe of Hamdan in one day. Their example was quickly followed by all the inhabitants of that province, except only those of Najran, who, being Christians, chose rather to pay tribute.

This was Mahometism established, and idolatry rooted out, even in Mahomet's lifetime (for he died the next year), throughout all Arabia, except only Yamama, where Moseilama, who set up also for a prophet as Mahomet's competitor, had a great party, and was not reduced till the kalifat of Abu Beer: and the Arabs being then united in one faith, and under one prince, found themselves in a condition of making those conquests which extended the Mahometan faith over so great a part of the world.

MAHOMET, the name of several emperors of the Turks; of whom the most celebrated is,

VOL. X. Part II.

Mahomet

MAHOMET II. furnished the *Great*, their seventh sultan. See *TURKEY*.

He was born at Adrianople the 24th of March 1430; and is to be remembered chiefly by us for taking Constantinople in 1453, and thereby driving many learned Greeks into the West, which was a great cause of the restoration of learning in Europe, as the Greek literature was then introduced here. He was one of the greatest men upon record, with regard to the qualities necessary to a conqueror: for he conquered two empires, twelve kingdoms, and two hundred considerable cities. He was very ambitious of the title of *Great*, and the Turks gave it him; even the Christians have not disputed it with him; for he was the first of the Ottoman emperors whom the Western nations dignified with the title of *Grand Seigneur* or *Great Turk*, which posterity has preserved to his descendants. Italy had suffered greater calamities, but she had never felt a terror equal to that which this sultan's victories imprinted. The inhabitants seemed already condemned to wear the turban: it is certain, that pope Sixtus IV. represented to himself Rome as already involved in the dreadful fate of Constantinople; and thought of nothing but escaping into Provence, and once more transferring the holy see to Avignon. Accordingly, the news of Mahomet's death, which happened the 3d of May 1481, was received at Rome with the greatest joy that ever was beheld there. Sixtus caused all the churches to be thrown open, made the tradespeople leave off their work, ordered a feast of three days, with public prayers and processions, commanded a discharge of the whole artillery of the castle of St Angelo all that time, and put a stop to his journey to Avignon.

He appears to be the first sultan who was a lover of arts and sciences; and even cultivated polite letters. He often read the History of Augustus, and the other Cæsars; and he perused those of Alexander, Constantine, and Theodosius, with more than ordinary pleasure, because these had reigned in the same country with himself. He was fond of painting, music, and sculpture; and he applied himself to the study of agriculture. He was much addicted to astrology; and used to encourage his troops by giving out, that the motion and influence of the heavenly bodies promised him the empire of the world. Contrary to the genius of his country, he delighted so much in the knowledge of foreign languages, that he not only spoke the Arabian, to which the Turkish laws, and the religion of their legislator Mahomet, are appropriated, but also the Persian, the Greek, and the French, that is, the corrupted Italian. Landin, a knight of Rhodes, collected several letters which this sultan wrote in the Syriac, Greek, and Turkish languages, and translated them into Latin. Where the originals are, nobody knows; but the translation has been published several times; as at Lyons 1520, in 4to; at Basil 1554, 12mo; in a collection published by Oporinus, at Marpurg 1604, in 8vo; and at Leipzig 1690, in 12mo. Melchior Junius, professor of eloquence at Strasburg, published at Montbéliard, 1595, a collection of letters, in which there are three written by Mahomet II. to Scanderbeg. One cannot discover the least air of Turkish ferocity in these letters: they are written in as civil terms, and as obliging a man-

Mahometanisin.

ner, as the most polite prince in Christendom could have written.

MAHOMETANISM, or MAHOMETISM, the system of religion broached by Mahomet, and still adhered to by his followers. See MAHOMET, and AL-CORAN.

Mahometanism is professed by the Turks, Persians, and several nations among the Africans, and many among the East-Indians.

The Mahometans divide their religion into two general parts, faith and practice: of which the first is divided into six distinct branches; Belief in God, in his angels, in his scriptures, in his prophets, in the resurrection and final judgment, and in God's absolute decrees. The points relating to practice are, Prayer, with washings, &c. alms, fasting, pilgrimage to Mecca, and circumcision.

I. Of the Mahometan *Faith*. 1. That both Mahomet, and those among his followers who are reckoned orthodox, had and continue to have just and true notions of God and his attributes, appears so plain from the Koran itself, and all the Mahometan divines, that it would be loss of time to refute those who suppose the God of Mahomet to be different from the true God, and only a fictitious deity or idol of his own creation.

2. The existence of angels, and their purity, are absolutely required to be believed in the Koran; and he is reckoned an infidel who denies there are such beings, or hates any of them, or asserts any distinction of sexes among them. They believe them to have pure and subtle bodies, created of fire; that they neither eat nor drink, nor propagate their species; that they have various forms and offices, some adoring God in different postures, others singing praises to him, or interceding for mankind. They hold, that some of them are employed in writing down the actions of men; others in carrying the throne of God, and other services.

The four angels, whom they look on as more eminently in God's favour, and often mention on account of the offices assigned them, are, Gabriel, to whom they give several titles, particularly those of the *holy spirit*, and the *angel of revelations*, supposing him to be honoured by God with a greater confidence than any other, and to be employed in writing down the divine decrees; Michael, the friend and protector of the Jews; Azrael, the *angel of death*, who separates mens souls from their bodies; and Israfil, whose office it will be to sound the trumpet at the resurrection. The Mahometans also believe, that two guardian angels attend on every man, to observe and write down his actions, being changed every day, and therefore called *al Moakibat*, or "the angels who continually succeed one another."

The devil, whom Mahomet names *Eblis*, from his *dispair*, was once one of those angels who are nearest to God's presence, called *Azazel*; and fell, according to the doctrine of the Koran, for refusing to pay homage to Adam at the command of God.

Besides angels and devils, the Mahometans are taught by the Koran to believe an intermediate order of creatures, which they call *jinn* or *genii*, created also of fire, but of a grosser fabric than angels, since they eat and drink, and propagate their species, and are

subject to death. Some of these are supposed to be good and others bad, and capable of future salvation or damnation, as men are; whence Mahomet pretended to be sent for the conversion of genii as well as men.

3. As to the scriptures, the Mahometans are taught by the Koran, that God, in divers ages of the world, gave revelations of his will in writing to several prophets, the whole and every one of which it is absolutely necessary for a good Moslem to believe. The number of these sacred books were, according to them, 104. Of which 10 were given to Adam, 50 to Seth, 30 to Edris or Enoch, 10 to Abraham; and the other four, being the Pentateuch, the Psalms, the Gospel, and the Koran, were successively delivered to Moses, David, Jesus, and Mahomet; which last being the seal of the prophets, those revelations are now closed, and no more are to be expected. All these divine books, except the four last, they agree to be now entirely lost, and their contents unknown; though the Sabians have several books which they attribute to some of the antediluvian prophets. And of those four, the Pentateuch, Psalms, and Gospel, they say, have undergone so many alterations and corruptions, that, though there may possibly be some part of the true word of God therein, yet no credit is to be given to the present copies in the hands of the Jews and Christians. The Mahometans have also a gospel in Arabic, attributed to St Barnabas; wherein the history of Jesus Christ is related in a manner very different from what we find in the true gospels, and correspondent to those traditions which Mahomet has followed in his Koran. Of this gospel the Moriscoes in Africa have a translation in Spanish; and there is, in the library of prince Eugene of Savoy, a manuscript of some antiquity, containing an Italian translation of the same gospel; made, it is to be supposed, for the use of renegades. This book appears to be no original forgery of the Mahometans; though they have, no doubt, interpolated and altered it since, the better to serve their purpose; and in particular, instead of the *Parables*, or *Comforters*, they have in this apocryphal gospel inserted the word *Periclyte*, that is, the "famous," or "illustrious;" by which they pretend their prophet was foretold by name, that being the signification of *Mohammed* in Arabic: and this they lay to justify that passage of the Koran, where Jesus Christ is formally asserted to have foretold his coming, under his other name of *Abmed*, which is derived from the same root as *Mohammed*, and of the same import. From these, or some other forgeries of the same stamp, it is that the Mahometans quote several passages, of which there are not the least footsteps in the New Testament.

4. The number of the prophets, which have been from time to time sent by God into the world, amounts to no less than 224,000, according to one Mahometan tradition; or to 124,000, according to another: among whom 313 were apostles, sent with special commissions to reclaim mankind from infidelity and superstition; and six of them brought new laws or dispensations, which successively abrogated the preceding: these were Adam, Noah, Abraham, Moses, Jesus, and Mahomet. All the prophets in general, the Mahometans believe to have been free from great

Mahometanisin.

Mahometanism.

Mahometanism.

has and errors of consequence, and professors of one and the same religion, that is, Islam, notwithstanding the different laws and institutions which they observed. They allow of degrees among them, and hold some of them to be more excellent and honourable than others. The first place they give to the revealers and establishers of new dispensations, and the next to the apostles.

In this great number of prophets, they not only reckon divers patriarchs and persons named in scripture, but not recorded to have been prophets (wherein the Jewish and Christian writers have sometimes led the way), as Adam, Seth, Lot, Ishmael, Nun, Joshua, &c. and introduce some of them under different names, as *Enoch*, *Heber*, and *Jethro*, who are called, in the Koran, *Edris*, *Hud*, and *Shoaib*; but several others whose very names do not appear in scripture (though they endeavour to find some persons there to fix them on), as Saleh, Khedr, Dhu'lkefi, &c.

5. The belief of a general resurrection and a future judgment.

When a corpse is laid in the grave, they say he is received by an angel, who gives him notice of the coming of the two examiners; who are two black livid angels, of a terrible appearance, named *Monker* and *Nakir*. These order the dead person to sit upright; and examine him concerning his faith, as to the unity of God, and the mission of Mahomet: if he answer rightly, they suffer the body to rest in peace, and it is refreshed by the air of paradise; but, if not, they beat him on the temples with iron maces, till he roars out for anguish so loud, that he is heard by all from east to west, except men and genii. They then press the earth on the corpse, which is gnawed and stung till the resurrection by 99 dragons, with seven heads each; or, as others say, their fins will become venomous beasts, the grievous ones stinging like dragons, the smaller like scorpions, and the other like serpents: circumstances which some understand in a figurative sense.

As to the soul, they hold, that, when it is separated from the body by the angel of death, who performs his office with ease and gentleness towards the good, and with violence towards the wicked, it enters into that which they call *al beraab*, or the interval between death and the resurrection. If the departed person was a believer, they say two angels meet it, who convey it to heaven, that its place there may be assigned, according to its merit and degree. For they distinguish the souls of the faithful into three classes: the first of prophets, whose souls are admitted into paradise immediately; the second of martyrs, whose spirits, according to a tradition of Mahomet, rest in the crops of green birds, which eat of the fruits and drink of the rivers of paradise; and the third of other believers, concerning the state of whose souls before the resurrection there are various opinions.

Though some among the Mahometans have thought that the resurrection will be merely spiritual, and no more than the returning of the soul to the place whence it first came (an opinion defended by Ebn Sina, and called by some the *opinion of the philosophers*); and others, who allow man to consist of body only, that it will be merely corporeal; the received opinion is,

that both body and soul will be raised: and their doctors argue strenuously for the possibility of the resurrection of the body, and dispute with great subtilty concerning the manner of it. But Mahomet has taken care to preserve one part of the body, whatever becomes of the rest, to serve for a basis of the future edifice, or rather a leaven for the mass which is to be joined to it. For he taught, that a man's body was entirely consumed by the earth, except only the bone called *al ajib*, which we name the *os coccygis*, or rump-bone; and that, as it was the first formed in the human body, it will also remain uncorrupted till the last day, as a seed from whence the whole is to be renewed; and this, he said, would be effected by a forty years rain, which God should send, and which would cover the earth to the height of 12 cubits, and cause the bodies to sprout forth like plants. Herein, also, is Mahomet beholden to the Jews; who say the same things of the bone Luz, excepting that what he attributes to a great rain, will be effected, according to them, by a dew, impregnating the dust of the earth.

The time of the resurrection the Mahometans allow to be a perfect secret to all but God alone; the angel Gabriel himself acknowledging his ignorance in this point, when Mahomet asked him about it. However, they say, the approach of that day may be known from certain signs which are to precede it. These signs they distinguish into two sorts, the lesser and the greater.

The lesser signs are, 1. The decay of faith among men. 2. The advancing of the meanest persons to eminent dignity. 3. That a maid-servant shall become the mother of her mistress (or master); by which is meant, either that towards the end of the world men shall be much given to sensuality, or that the Mahometans shall then take many captives. 4. Tumults and seditions. 5. A war with the Turks. 6. Great distress in the world, so that a man, when he passes by another's grave, shall say, Would to God I were in his place. 7. That the provinces of Irac and Syria shall refuse to pay their tribute. And, 8. That the buildings of Median shall reach to Ahab, or Yahab.

The greater signs are, 1. The sun's rising in the west; which some have imagined it originally did. 2. The appearance of the beast, which shall rise out of the earth, in the temple of Mecca, or on mount Safa, or in the territory of Tayef, or some other place. This beast, they say, is to be 60 cubits high; though others, not satisfied with so small a size, will have her reach to the clouds and to heaven, when her head only is out; and that she will appear for three days, but show only a third part of her body. They describe this monster, as to her form, to be a compound of various species; having the head of a bull, the eyes of a hog, the ears of an elephant, the horns of a stag, the neck of an ostrich, the breast of a lion, the colour of a tiger, the back of a cat, the tail of a ram, the legs of a camel, and the voice of an ass. Some say this beast is to appear three times in several places, and that she will bring with her the rod of Moses and the seal of Solomon; and, being so swift that none can overtake or escape her, will with the first strike all the believers on the face, and mark them with the word *mumen*, i. e. believer; and with the latter will mark the unbelievers on the face likewise, with the

Mahometanism.

word *Cafir*, i. e. infidel, that every person may be known for what he really is. They add, that the same beast is to demonstrate the vanity of all religions except Islam, and to speak Arabic. All this stuff seems to be the result of a confused idea of the beast in the Revelations. 3. War with the Greeks, and the taking Constantinople by 70,000 of the posterity of Isaac, who shall not win that city by force of arms, but the walls shall fall down while they cry out, *There is no God but God, God is most great!* As they are dividing the spoil, news will come to them of the appearance of Antichrist; whereupon they shall leave all, and return back. 4. The coming of Antichrist, whom the Mahometans call *Mashū al Dajjal*, i. e. the false or lying Christ, and simply *Dajjal*. He is to be one-eyed, and marked on the forehead with the letters C. F. R. signifying *Cafir*, or infidel. They say that the Jews give him the name of *Messiah Ben David*; and pretend he is to come in the last days, and to be lord both of land and sea, and that he will restore the kingdom to them. 5. The descent of Jesus on earth. They pretend that he is to descend near the white tower to the east of Damascus, when the people are returned from the taking of Constantinople: that he is to embrace the Mahometan religion, marry a wife, get children, kill Antichrist; and at length die after 40 years, or, according to others, 24 years continuance on earth. Under him, they say, there will be great security and plenty in the world, all hatred and malice being laid aside; when lions and camels, bears and sheep, shall live in peace, and a child shall play with serpents unhurt. 6. War with the Jews; of whom the Mahometans are to make a prodigious slaughter, the very trees and stones discovering such of them as hide themselves, except only the tree called *gharkad*, which is the tree of the Jews. 7. The eruption of Gog and Magog, or, as they are called in the east, *Tajuj* and *Majuj*; of whom many things are related in the Koran and the traditions of Mahomet. These barbarians, they tell us, having passed the lake of Tiberias, which the vanguard of their vast army will drink dry, will come to Jerusalem, and there greatly distress Jesus and his companions; till, at his request, God will destroy them, and fill the earth with their carcasses, which, after some time, God will send birds to carry away, at the prayers of Jesus and his followers. Their bows, arrows, and quivers, the Moslems will burn for seven years together; and at last, God will send a rain to cleanse the earth and to make it fertile. 8. A smoke which shall fill the whole earth. 9. An eclipse of the moon. Mahomet is reported to have said, that there would be three eclipses before the last hour; one to be seen in the east, another in the west, and the third in Arabia. 10. The returning of the Arabs to the worship of Allah and Uzza, and the rest of their ancient idols, after the decay of every one in whose heart there was faith equal to a grain of mustard-seed, none but the very worst of men being left alive. For God, they say, will send a cold odoriferous wind, blowing from Syria Damascus, which shall sweep away the souls of all the faithful, and the Koran itself, so that men will remain in the grossest ignorance for 100 years. 11. The discovery of a vast heap of gold and silver by the retreating of the

Euphrates, which will be the destruction of many. 12. The demolition of the Caaba, or temple of Mecca, by the Ethiopians. 13. The speaking of beasts and inanimate things. 14. The breaking out of fire in the province of Hejaz; or, according to others, in Yaman. 15. The appearance of a man of the descendants of Kahtan, who shall drive men before him with his staff. 16. The coming of the Mohdi, or director; concerning whom Mahomet prophesied, that the world should not have an end till one of his own family should govern the Arabians, whose name should be the same with his own name, and whose father's name should also be the same with his father's name; and who should fill the earth with righteousness. This person the Shiites believe to be now alive, and concealed in some secret place till the time of his manifestation; for they suppose him no other than the last of the 12 Imams, named *Mahomet Abu'l-kasem*, as their prophet was; and the son of Hassan al Alkeri, the 11th of that succession. He was born at Sermanrai, in the 255th year of the Hegira. From this tradition, it is to be presumed, an opinion pretty current among the Christians took its rise, that the Mahometans are in expectation of their prophet's return. 17. A wind which shall sweep away the souls of all who have but a grain of faith in their hearts, as has been mentioned under the tenth sign.

These are the greater signs, which, according to their doctrine, are to precede the resurrection, but still leave the hour of it uncertain: for the immediate sign of its being come will be the first blast of the trumpet, which they believe will be sounded three times. The first they call the *blast of consternation*; at the hearing of which all creatures in heaven and earth shall be struck with terror, except those whom God shall please to exempt from it. The effects attributed to this first found of the trumpet are very wonderful: for they say, the earth will be shaken, and not only all buildings, but the very mountains levelled; that the heavens shall melt, the sun be darkened, the stars fall, on the death of the angels, who, as some imagine, hold them suspended between heaven and earth; and the sea shall be troubled and dried up, or, according to others, turned into flames, the sun, moon, and stars being thrown into it: the Koran, to express the greatness of the terror of that day, adds, that women who give suck shall abandon the care of their infants, and even the she camels which have gone 10 months with young (a most valuable part of the subsistence of that nation) shall be utterly neglected. A farther effect of this blast will be that concourse of beasts mentioned in the Koran, though some doubt whether it be to precede the resurrection or not. They who suppose it will precede, think that all kinds of animals, forgetting their respective natural fierceness and timidity, will run together into one place, being terrified by the found of the trumpet and the sudden shock of nature.

The Mahometans believe that this first blast will be followed by a second, which they call the *blast of extinction*; by which all creatures both in heaven and earth shall die or be annihilated, except those which God shall please to exempt from the common fate; and this, they say, shall happen in the twinkling of an eye, nay in an instant; nothing surviving except God alone, with

Mahometanism.

with paradise and hell, and the inhabitants of those two places, and the throne of glory. The last who shall die will be the angel of death.

Forty years after this will be heard the *blast of resurrection*, when the trumpet shall be sounded the third time by Israél, who, together with Gabriel and Michael, will be previously restored to life, and, standing on the rock of the temple of Jerusalem, shall, at God's command, call together all the dry and rotten bones, and other dispersed parts of the bodies, and the very hairs to judgment. This angel, having, by the divine order, set the trumpet to his mouth, and called together all the souls from all parts, will throw them into his trumpet, from whence, on his giving the last sound, at the command of God, they will fly forth like bees, and fill the whole space between heaven and earth, and then repair to their respective bodies, which the opening earth will suffer to arise; and the first who shall so arise, according to a tradition of Mahomet, will be himself. For this birth the earth will be prepared by the rain above-mentioned, which is to fall continually for 40 years, and will resemble the seed of a man, and be supplied from the water under the throne of God, which is called *living water*; by the efficacy and virtue of which the dead bodies shall spring forth from their graves, as they did in their mother's womb, or as corn sprouts forth by common rain, till they become perfect; after which breath will be breathed into them, and they will sleep in their sepulchres till they are raised to life at the last trumpet.

When those who have risen shall have waited the limited time, the Mahometans believe God will at length appear to judge them; Mahomet undertaking the office of intercessor, after it shall have been declined by A' am, Noah, Abraham, and Jesus, who shall beg deliverance only for their own souls. They say, that on this solemn occasion God will come in the clouds surrounded by angels, and will produce the books wherein the actions of every person are recorded by their guardian angels, and will command the prophets to bear witness against those to whom they have been respectively sent. Then every one will be examined concerning all his words and actions uttered and done by him in this life; not as if God needed any information in these respects, but to oblige the person to make public confession and acknowledgement of God's justice. The particulars of which they shall give an account, as Mahomet himself enumerated them, are, of their time, how they spent it; of their wealth, by what means they acquired it, and how they employed it; of their bodies, wherein they exercised them; of their knowledge and learning, what use they made of them. To the questions we have mentioned each person shall answer, and make his defence in the best manner he can, endeavouring to excuse himself by casting the blame of his evil deeds on others; so that a dispute shall arise even between the soul and the body, to which of them their guilt ought to be imputed: the soul saying, *O Lord, my body I received from thee; for thou createdst me without a hand to lay hold with, a foot to walk with, an eye to see with, or an understanding to apprehend with, till I came and entered into this body; therefore punish it eternally, but deliver me.* The body, on the other side, will make this apology: *O Lord, thou createdst me like a flock of wood, having neither*

hand that I could lay hold with, nor foot that I could walk with, till this soul, like a ray of light, entered into me, and my tongue began to speak, my eye to see, and my foot to walk; therefore punish it eternally, but deliver me. But God will propound to them the following parable of the blind man and the lame man, which, as well as the preceding dispute, was borrowed by the Mahometans from the Jews. A certain king, having a pleasant garden, in which were ripe fruits, set two persons to keep it, one of whom was blind, and the other lame; the former not being able to see the fruit, nor the latter to gather it: the lame man, however, seeing the fruit, persuaded the blind man to take him upon his shoulders, and by that means he easily gathered the fruit; which they divided between them. The lord of the garden coming some time after, and inquiring after his fruit, each began to excuse himself: the blind man said he had no eyes to see with; and the lame man, that he had no feet to approach the trees. But the king, ordering the lame man to be set on the blind, passed sentence on and punished them both. And in the same manner will God deal with the body and the soul. As these apologies will not avail on that day, so it will be in vain for any one to deny his evil actions; since men and angels, and his own members, nay, the very earth itself, will be ready to bear witness against him.

At this examination, they also believe, that each person will have the book wherein all the actions of his life are written delivered to him: which books the righteous will receive into their right hand, and read with great pleasure and satisfaction; but the ungodly will be obliged to take them, against their wills, in their left, which will be bound behind their backs, their right hand being tied up to their necks.

To show the exact justice which will be observed on this great day of trial, the next thing they describe is the balance, wherein all things shall be weighed. They say it will be held by Gabriel; and that it is of so vast a size, that its two scales, one of which hangs over paradise, and the other over hell, are capacious enough to contain both heaven and hell. Though some are willing to understand what is said in the Koran concerning this balance allegorically, and only as a figurative representation of God's equity; yet the more ancient and orthodox opinion is, that they are to be taken literally; and since words and actions, being mere accidents, are not capable of being themselves weighed, they say that the books wherein they are written will be thrown into the scales, and according as those wherein the good or evil actions are recorded shall preponderate, sentence will be given: those whose balances laden with good works shall be heavy, will be saved; but those whose balances are light, will be condemned. Nor will any one have cause to complain that God suffers any good action to pass unrewarded, because the wicked for the good they do have their reward in this life, and therefore can expect no favour in the next.

This examination being past, and every one's works weighed in a just balance, that mutual retaliation will follow, according to which every creature will take vengeance one of another, or have satisfaction made them for the injuries which they have suffered. And, since there will then be no other way of returning like for

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Mahome-
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like, the manner of giving this satisfaction will be by taking away a proportional part of the good works of him who offered the injury, and adding it to those of him who suffered it. Which being done, if the angels (by whose ministry this is to be performed) say, *Lord, we have given to every one his due, and there remaineth of this person's good works so much as equalleth the weight of an ant*, God will, of his mercy, cause it to be doubled unto him, that he may be admitted into paradise; but if, on the contrary, his good works be exhausted, and there remain evil works only, and there be any who have not yet received satisfaction from him, God will order that an equal weight of their sins be added unto his, that he may be punished for them in their stead, and he will be sent to hell laden with both. This will be the method of God's dealing with mankind. As to brutes, after they shall have likewise taken vengeance of one another, he will command them to be changed into dust; wicked men being referred to more grievous punishment, so that they shall cry out, on hearing this sentence passed on the brutes, *Would to God that we were dust also*. As to the genii, many Mahometans are of opinion, that such of them as are true believers, will undergo the same fate as the irrational animals, and have no other reward than the favour of being converted into dust; and for this they quote the authority of their prophet.

The trials being over, and the assembly dissolved, the Mahometans hold, that those who are to be admitted into paradise will take the right-hand way, and those who are destined to hell-fire will take the left; but both of them must first pass the bridge called in Arabic *al Sirat*, which they say is laid over the midst of hell, and describe to be finer than a hair, and sharper than the edge of a sword; so that it seems very difficult to conceive how any one shall be able to stand upon it: for which reason, most of the sect of the Motazalites reject it as a fable; though the orthodox think it a sufficient proof of the truth of this article, that it was seriously affirmed by him who never asserted a falsehood, meaning their prophet: who, to add to the difficulty of the passage, has likewise declared, that this bridge is beset on each side with briars and hooked thorns: which will however be no impediment to the good; for they shall pass with wonderful ease and swiftness, like lightning, or the wind, Mahomet and his Moslems leading the way; whereas the wicked, what with the slipperiness and extreme narrowness of the path, the intangling of the thorns, and the extinction of the light which directed the former to paradise, will soon miss their footing, and fall down headlong into hell, which is gaping beneath them.

As to the punishment of the wicked, the Mahometans are taught, that hell is divided into seven stories or apartments, one below another, designed for the reception of as many distinct classes of the damned. The first, which they call *Jehennam*, they say, will be the receptacle of those who acknowledged one God, that is, the wicked Mahometans; who, after having there been punished according to their demerits, will at length be released. The second, named *Ladha*, they assign to the Jews; the third, named *al Hotana*, to the Christians; the fourth, named *al Sair* to the Sabians; the fifth, named *Sakar*, to the Magians; the sixth, named *al Jahim*, to the idolaters; and the

Mahome-
tanism.

seventh, which is the lowest and worst of all, and is called *al Hawyat*, to the hypocrites, or those who outwardly professed some religion, but in their hearts were of none. Over each of these apartments they believe there will be set a guard of angels, 19 in number; to whom the damned will confess the just judgment of God, and beg them to intercede with him for some alleviation of their pain, or that they may be delivered by being annihilated.

Mahomet has, in his Koran and traditions, been very exact in describing the various torments of hell, which, according to him, the wicked will suffer both from intense heat and excessive cold. We shall, however, enter into no detail of them here; but only observe, that the degrees of these pains will also vary in proportion to the crimes of the sufferer, and the apartment he is condemned to; and that he who is punished the most lightly of all will be shod with shoes of fire, the fervour of which will cause his skull to boil like a cauldron. The condition of these unhappy wretches, as the same prophet teaches, cannot be properly called either *life or death*; and their misery will be greatly increased by their despair of being ever delivered from that place, since, according to that frequent expression in the Koran, *they must remain therein for ever*. It must be remarked, however, that the infidels alone will be liable to eternity of damnation; for the Moslems, or those who have embraced the true religion, and have been guilty of heinous sins, will be delivered thence after they shall have expiated their crimes by their sufferings. The time which these believers shall be detained there, according to a tradition handed down from their prophet, will not be less than 900 years, nor more than 7000. And, as to the manner of their delivery, they say that they shall be distinguished by the marks of prostration on those parts of their bodies with which they used to touch the ground in prayer, and over which the fire will therefore have no power; and that, being known by this characteristic, they will be released by the mercy of God, at the intercession of Mahomet and the blessed; whereupon those who shall have been dead, will be restored to life, as has been said; and those whose bodies shall have contracted any footsies or filth from the flames and smoke of hell, will be immersed in one of the rivers of paradise, called the *river of life*, which will wash them whiter than pearls.

The righteous, as the Mahometans are taught to believe, having surmounted the difficulties, and passed the sharp bridge abovementioned, before they enter paradise, will be refreshed by drinking at the *pond* of their prophet, who describes it to be an exact square of a month's journey in compass; its water, which is supplied by two pipes from al Cawthar, one of the rivers of paradise, being whiter than milk or silver, and more odoriferous than musk, with as many cups set around it as there are stars in the firmament; of which water whoever drinks will thirst no more for ever. This is the first taste which the blessed will have of their future and now near-approaching felicity.

Though paradise be so very frequently mentioned in the Koran, yet it is a dispute among the Mahometans whether it be already created, or to be created hereafter; the Motazalites and some other sectaries

Mahometan.

sectaries asserting, that there is not at present any such place in nature, and that the paradise which the righteous will inhabit in the next life will be different from that from which Adam was expelled. However, the orthodox profess the contrary, maintaining that it was created even before the world, and describe it, from their prophet's traditions, in the following manner.

They say it is situated above the seven heavens (or in the seventh heaven), and next under the throne of God; and, to express the amenity of the place, tell us, that the earth of it is of the finest wheat-flour, or of the purest musk, or, as others will have it, of saffron: that its stones are pearls and jacinths, the walls of its buildings enriched with gold and silver, and that the trunks of all its trees are of gold: among which the most remarkable is the tree called *Tuba*, or the tree of happiness. Concerning this tree, they fable, that it stands in the palace of Mahomet, though a branch of it will reach to the house of every true believer; that it will be laden with pomegranates, grapes, dates, and other fruit, of surprising bigness, and of tastes unknown to mortals. So that, if a man desire to eat of any particular kind of fruit, it will immediately be presented him; or, if he choose flesh, birds ready dressed will be set before him, according to his wish. They add, that the boughs of this tree will spontaneously bend down to the hand of the person who would gather of its fruits, and that it will supply the blessed not only with food, but also with silken garments, and beasts to ride on ready saddled and bridled, and adorned with rich trappings, which will burst forth from its fruits; and that this tree is so large, that a person, mounted on the swiftest horse, would not be able to gallop from one end of its shade to the other in 100 years.

As plenty of water is one of the greatest additions to the pleasantness of any place, the Koran often speaks of the rivers of paradise as a principal ornament thereof: some of these rivers, they say, flow with water, some with milk, some with wine, and others with honey; all taking their rise from the root of the tree *Tuba*.

But all these glories will be eclipsed by the resplendent and ravishing girls of paradise, called, from their large black eyes, *Hur al oyan*, the enjoyment of whose company will be a principal felicity of the faithful. These, they say, are created, not of clay, as mortal women are, but of pure musk; being, as their prophet often affirms in his Koran, free from all natural impurities, defects, and inconveniences incident to the sex, of the strictest modesty, and secluded from public view in pavilions of hollow pearls, so large, that as some traditions have it, one of them will be no less than four parasangs (or, as others say, 60 miles) long, and as many broad.

The name which the Mahometans usually give to this happy mansion, is *al Jannat*, or "the garden;" and sometimes they call it, with an addition, *Jannat al Ferdaws*, "the garden of paradise;" *Jannat Eden*, "the garden of Eden," (though they generally interpret the word *Eden*, not according to its acceptation in Hebrew, but according to its meaning in their own tongue, wherein it signifies "a settled or perpetual habitation;") *Jannat al Marwa*, "the garden of

Mahometan.

abode;" *Jannat al Naim*, "the garden of pleasure;" and the like: by which several appellations some understand so many different gardens, or at least places of different degrees of felicity (for they reckon no less than 100 such in all), the very meanest whereof will afford its inhabitants so many pleasures and delights, that one would conclude they must even sink under them, had not Mahomet declared, that, in order to qualify the blessed for a full enjoyment of them, God will give to every one the abilities of 100 men.

6. God's absolute decree and predestination both of good and evil. The orthodox doctrine is, that whatever hath or shall come to pass in this world, whether it be good, or whether it be bad, proceedeth entirely from the divine will, and is irrevocably fixed and recorded from all eternity in the preserved table: God having secretly predetermined not only the adverse and prosperous fortune of every person in this world, in the most minute particulars, but also his faith or infidelity, his obedience or disobedience, and consequently his everlasting happiness or misery after death; which fate or predestination it is not possible by any foresight or wisdom to avoid.

Of this doctrine Mahomet makes great use in his Koran for the advancement of his designs; encouraging his followers to fight without fear, and even desperately, for the propagation of their faith, by representing to them, that all their caution could not avert their inevitable destiny, or prolong their lives for a moment; and deterring them from disobeying or rejecting him as an impostor, by setting before them the danger they might thereby incur of being, by the just judgment of God, abandoned to seduction, hardness of heart, and a reprobate mind, as a punishment for their obstinacy.

II. *Religious practice*. 1. The first point is *prayer*, under which are also comprehended those legal washings or purifications which are necessary preparations thereto.

Of these purifications there are two degrees, one called *ghusl*, being a total immersion or bathing of the body in water; and the other called *wudu* (by the Persians, *aldest*), which is the washing of their faces, hands, and feet, after a certain manner. The first is required in some extraordinary cases only, as after having lain with a woman, or being polluted by emission of seed, or by approaching a dead body; women also being obliged to it after their courses or childbirth. The latter is the ordinary ablution in common cases, and before prayer, and must necessarily be used by every person before he can enter upon that duty. It is performed with certain formal ceremonies, which have been described by some writers, but much easier apprehended by seeing them done, than by the best description.

That his followers might be more punctual in this duty, Mahomet is said to have declared, that the practice of religion is founded on cleanliness, which is the one half of the faith, and the key of prayer, without which it will not be heard by God. That these expressions may be the better understood, al Ghazali reckons four degrees of purification; of which the first is the cleansing of the body from all pollution, filth, and excrements; the second, the cleansing of the members of the

Mahometanism.

the body from all wickedness and unjust actions; the third, the cleansing the heart from all blameable inclinations and odious vices; and the fourth, the purging a man's secret thoughts from all affections which may divert their attendance on God; adding, that the body is but as the outward shell, in respect to the heart, which is as the kernel.

Circumcision, though it be not so much as once mentioned in the Koran, is yet held by the Mahometans to be an ancient divine institution, confirmed by the religion of Islam, and, though not so absolutely necessary but that it may be dispensed with in some cases, yet highly proper and expedient. The Arabs used this rite for many ages before Mahomet, having probably learned it from Ishmael, though not only his descendants, but the Hamyarites and other tribes practised the same. The Ishmaelites, we are told, used to circumcise their children, not on the eighth day, as is the custom of the Jews, but when about 12 or 13 years old, at which age their father underwent that operation; and the Mahometans imitate them so far as not to circumcise children before they may be able at least distinctly to pronounce that profession of their faith, *There is no God but God, Mahomet is the apostle of God*; but pitch on what age they please for the purpose, between 6 and 16, or thereabouts.

Prayer was by Mahomet thought so necessary a duty, that he used to call it *the pillar of religion, and the key of paradise*; and when the Thakifites, who dwelt at Tayef, sending, in the ninth year of the Hegira, to make their submission to the prophet, after the keeping of their favourite idol had been denied them, begged at least, that they might be dispensed with as to their saying of their appointed prayers, he answered, *That there could be no good in that religion wherein was no prayer*.

That so important a duty, therefore, might not be neglected, Mahomet obliged his followers to pray five times every 24 hours, at certain stated times; viz. 1. In the morning before sun-rise: 2. When noon is past, and the sun begins to decline from the meridian: 3. In the afternoon, before sun-set: 4. In the evening, after sun-set, and before day be shut in; and, 5. After the day is shut in, and before the first watch of the night. For this institution he pretended to have received the divine command from the throne of God himself, when he took his night-journey to heaven; and the observing of the stated times of prayer is frequently insisted on in the Koran, though they be not particularly prescribed therein. Accordingly, at the aforesaid times, of which public notice is given by the Mueddhins, or Criers, from the steeples of their mosques (for they use no bells), every conscientious Moslem prepares himself for prayer, which he performs either in the mosque or any other place, provided it be clean, after a prescribed form, and with a certain number of praises or ejaculations (which the more scrupulous count by a string of beads), and using certain postures of worship; all which have been particularly set down and described, though with some few mistakes, by other writers, and ought not to be abridged, unless in some special cases, as on a journey, on preparing for battle, &c.

For the regular performance of the duty of prayer among the Mahometans, besides the particulars above N^o 192.

Mahometanism.

mentioned, it is also requisite that they turn their faces, while they pray, towards the temple of Mecca; the quarter where the same is situated, being, for that reason, pointed out within their mosques by a nich, which they call *al Mebrab*; and without, by the situation of the doors opening into the galleries of the steeples: there are also tables calculated for the ready finding out their Keblah, or part towards which they ought to pray, in places where they have no other direction.

2. *Alms* are of two sorts, *legal* and *voluntary*. The *legal alms* are of indispensable obligation, being commanded by the law, which directs and determines both the portion which is to be given, and of what things it ought to be given; but the *voluntary alms* are to every one's liberty, to give more or less, as he shall see fit. The former kind of alms some think to be properly called *zacas*, and the latter *sadakat*; though this name be also frequently given to the legal alms. They are called *zacas*, either because they *increase* a man's store by drawing down a blessing thereon, and produce in his soul the virtue of liberality; or because they *purify* the remaining part of one's substance from pollution, and the soul from the filth of avarice; and *sadakat*, because they are a proof of a man's sincerity in the worship of God. Some writers have called the legal alms *tithe*s; but improperly, since in some cases they fall short, and in others exceed that proportion.

3. *Fasting* is a duty of so great moment, that Mahomet used to say it was *the gate of religion*, and that the odour of the mouth of him who fasteth is more grateful to God than that of musk; and al Ghazali reckons fasting *one fourth part of the faith*. According to the Mahometan divines, there are three degrees of fasting: 1. The restraining the belly and other parts of the body from satisfying their lusts: 2. The restraining the ears, eyes, tongue, hands, feet, and other members, from sin; and, 3. The fasting of the heart from worldly cares, and restraining the thought from every thing besides God.

The Mahometans are obliged, by the express command of the Koran, to fast the whole month of Ramadan, from the time the new moon first appears, till the appearance of the next new moon; during which time they must abstain from eating, drinking, and women, from day-break till night or sun-set. And this injunction they observe so strictly, that, while they fast, they suffer nothing to enter their mouths, or other parts of their body, esteeming the fast broken and null, if they smell perfumes, take a clyster or injection, bathe, or even purposely swallow their spittle; some being so cautious, that they will not open their mouths to speak lest they should breathe the air too freely: the fast is also deemed void, if a man kiss or touch a woman, or if he vomit designedly. But after sun-set they are allowed to refresh themselves, and to eat and drink, and enjoy the company of their wives till day-break; though the more rigid begin the fast again at midnight. This fast is extremely rigorous and mortifying when the month of Ramadan happens to fall in summer (for the Arabian year being lunar, each month runs through all the different seasons in the course of 32 years), the length and heat of the days making the observance of it much more difficult and uneasy than in winter.

Mahome-
tanism.

The reason given why the month of Ramadan was pitched on for this purpose is, that on that month the Koran was sent down from heaven. Some pretend, that Abraham, Moses, and Jesus, received their respective revelations in the same month.

4. The pilgrimage to Mecca is so necessary a point of practice, that, according to a tradition of Mahomet, he who dies without performing it may as well die a Jew or a Christian; and the same is expressly commanded in the Koran.

The temple of Mecca stands in the midst of the city, and is honoured with the title of *Masjad al elbaram*, i. e. the *hallowed or inviolable temple*. What is principally revered in this place, and gives sanctity to the whole, is a square stone building, called the *CAABA*; (see that article).

To this temple every Mahometan, who has health and means sufficient, ought, once at least in his life, to go on pilgrimage; nor are women excused from the performance of this duty. The pilgrims meet at different places near Mecca, according to the different parts from whence they come, during the months of Shawal and Dhu'lkaada; being obliged to be there by the beginning of Dhu'lhajja; which month, as its name imports, is peculiarly set apart for the celebration of this solemnity.

At the place above mentioned the pilgrims properly commence such; when the men put on the Ibrahim sacred habit, which consists only of two woollen wrappers, one wrapped about their middle to cover their privities, and the other thrown over their shoulders, having their heads bare, and a kind of slippers which cover neither the heel nor the instep, and so enter the sacred territory in their way to Mecca. While they have this habit on, they must neither hunt nor fowl, (though they are allowed to fish); which precept is so punctually observed, that they will not kill even a louse or flea if they find them on their bodies: there are some noxious animals, however, which they have permission to kill during the pilgrimage, as kites, ravens, scorpions, mice, and dogs given to bite. During the pilgrimage, it behoves a man to have a constant guard over his words and actions; to avoid all quarrelling or ill-language, all converse with women, and all obscene discourse; and to apply his whole attention to the good work he is engaged in.

The pilgrims, being arrived at Mecca, immediately visit the temple; and then enter on the performance of the prescribed ceremonies, which consist chiefly in going in procession round the Caaba, in running between the mounts Safa and Merwa, in making the station on mount Arafat, and slaying the victims, and shaving their heads in the valley of Mina.

In compassing the Caaba, which they do seven times, beginning at the corner where the black stone is fixed, they use a short quick pace, the three first times they go round it, and a grave ordinary pace the four last; which, it is said, was ordered by Mahomet, that his followers might show themselves strong and active to cut off the hopes of the infidels, who gave out that the immoderate heats of Medina had rendered them weak. But the aforesaid quick pace they are not obliged to use every time they perform this piece of devotion, but only at some particular times.

Vol. X. Part II.

Mahome-
tanism.

So often as they pass by the black stone, they either kiss it, or touch it with their hand and kiss that.

The running between Safa and Merwa is also performed seven times, partly with a slow pace and partly running; for they walk gravely till they come to a place between two pillars; and there they run, and afterwards walk again; sometimes looking back, and sometimes stopping, like one who had lost something, to represent Hagar seeking water for her son; for the ceremony is said to be as ancient as her time.

On the ninth of Dhu'lhajja, after morning-prayer, the pilgrims leave the valley of Mina, whither they come the day before; and proceed in a tumultuous and rushing manner to mount Arafat, where they stay to perform their devotions till sun-set: then they go to Mozdalifa, an oratory between Arafat and Mina; and there spend the night in prayer and reading the Koran. The next morning by day break they visit *al Masjid al Karam*, or "the sacred monument;" and, departing thence before sun-rise, haste by Batn Mohaffer to the valley of Mina; where they throw seven stones at three marks or pillars, in imitation of Abraham, who, meeting the devil in that place, and being by him disturbed in his devotions, or tempted to disobedience when he was going to sacrifice his son, was commanded by God to drive him away by throwing stones at him; though others pretend this rite to be as old as Adam, who also put the devil to flight in the same place, and by the same means.

This ceremony being over, on the same day, the tenth of Dhu'lhajja, the pilgrims flay their victims in the said valley of Mina; of which they and their friends eat part, and the rest is given to the poor. These victims must be either sheep, goats, kine, or camels; males, if of either of the two former kinds; and females if of either of the latter; and of a fit age. The sacrifices being over, they shave their heads and cut their nails, burying them in the same place; after which the pilgrimage is looked on as completed; though they again visit the Caaba, to take their leave of that sacred building.

The rapid success which attended the propagation of this new religion was owing to causes that are plain and evident, and must remove, or rather prevent, our surprize, when they are attentively considered. The terror of Mahomet's arms, and the repeated victories which were gained by him and his successors, were, no doubt, the irresistible arguments that persuaded such multitudes to embrace his religion and submit to his dominion. Besides, his law was artfully and marvellously adapted to the corrupt nature of man; and, in a more particular manner, to the manners and opinions of the eastern nations, and the vices to which they were naturally addicted: for the articles of faith which it proposed were few in number, and extremely simple; and the duties it required were neither many nor difficult, nor such as were incompatible with the empire of appetites and passions. It is to be observed farther, that the gross ignorance, under which the Arabians, Syrians, Persians, and the greatest part of the eastern nations, laboured at this time, rendered many an easy prey to the artifice and cloquence of this bold adventurer. To these causes of the progress of Mahometism, we may add the bitter dissensions and

Mahometanism.
Mahwah.
 cruel animosities that reigned among the Christian sects, particularly the Greeks, Nestorians, Eutychians, and Monophysites; dissensions that filled a great part of the East with carnage, assassinations, and such detestable enormities, as rendered the very name of Christianity odious to many. We might add here, that the Monophysites and Nestorians, full of resentment against the Greeks, from whom they had suffered the bitterest and most injurious treatment, assisted the Arabians in the conquest of several provinces, into which, of consequence, the religion of Mahomet was afterwards introduced. Other causes of the sudden progress of that religion will naturally occur to such as consider attentively its spirit and genius, and the state of the world at this time.

MAHOMETANS, those who believe in the religion and divine mission of Mahomet. See **MAHOMET**, **MAHOMETANISM**, and **ALCORAN**.

MAHRATTA. See **MAHRATTA**.

MAHWAH, or **MAWE**, in botany; an East-Indian tree, so called by the natives of Bahar and the neighbouring countries, but of which the Shanferit name is *Madhuca* or *Madudruma*. According to Lieut. C. Hamilton, by whom a very particular account of this tree is given in the *Asiatic Researches* I, it is of the class of the polyandria-monogynia of Linnæus, but of a genus not described by him. The calyx is monophyllous, quadrifid, half divided, and imbricated in its divided part; the two opposite and outer parts covering partially the two opposite and inner. The corolla is monopetalous, having an inflated tube for its lower part, of near an inch long, thick, fleshy, and of a cream colour: from this arise nine small leaves, as it were, like petals from a calyx, that are imbricated and twisted, one over the other, from right to left, clasping the lower part of the style in a point; by which they seem to serve, in some respect, like a forceps, to detach the whole corolla at the season of its dropping. There are no filaments; but the antheræ, which are in number most commonly twenty-six, long, scabrous, and spear-headed, are inserted in rows, on the inside and upper part of the tube of the corolla. The style is long, round, and tapering, and projects about an inch beyond the corolla; it is succeeded by a drupe, with a thick pericarpium, bilocular, containing two seeds or kernels covered with a dark brown skin: there are often, however, three of these, in three separate divisions. The flowers rise in bunches, from the extremities of the smaller branches; and have each a pedicel of about an inch and a half long: these are mostly turned downwards, whence the corollas more easily drop off.

The tree, when full grown, is about the size of a common Mango tree, with a bushy head and oval leaves a little pointed; its roots spreading horizontally, are sunk but little in the earth: the trunk, which is often of a considerable thickness, rises seldom to any great height, without giving off branches; it is, however, not uncommon to see it shoot up clear to the length of eight or ten feet: the wood itself is moderately hard, fine grained, and of a reddish colour. By incision the tree affords a resinous gum from the bark.

The flowers are of a nature very extraordinary, "differing essentially (says Mr Hamilton) from those of any other plant with which I am acquainted, as they

have not, in any respect, the usual appearance of such, but rather resemble berries; and I, like many others, had long conceived them to be the fruit of the Mahwah." The tree drops its leaves in the month of February, and early in March these flowers begin to come out in clusters of thirty, forty, or fifty, from the extremity of every small branch; and, from this period till the latter end of April, as the flowers come to maturity (for they never open or expand), they continue falling off, with their antheræ, in the mornings, a little after sun-rise; when they are gathered; and afterwards dried by an exposure of a few days in the sun: when thus prepared, they very much resemble a dried grape, both in taste and flavour. Immediately after the flowers drop off, fresh shoots are made for the new leaves, which soon make their appearance, coming presently to their full growth.

The fruit (*properly* so called) is of two sorts in shape; the one resembling a small walnut, the other somewhat larger and pointed: it is ripe towards the middle of May; and continues dripping from the tree till the whole fall, which is generally about the beginning or towards the middle of June. The outer covering, or *pericarpium*, which is of a soft texture, commonly bursts in the fall, so that the seeds are very easily squeezed out of it: the seeds are somewhat of the shape but longer than an olive. These seeds are replete with a thick oil, of the consistence of butter or ghee, which is obtained by expression.

From this description it may easily be conceived, that the Mahwah tree and its productions are of singular and general use, especially in those dry and barren countries, which, from the nature of their situation, are not so well calculated for producing in plenty or perfection the other necessaries of life.

The corolla or flowers, after being dried as before described, are eaten by the natives raw or dressed with their *curries*; and, when even simply boiled with rice, they afford a strengthening and wholesome nourishment. They are indeed, our author tells us, often applied to a less laudable purpose; for being fermented, they yield by distillation a strong spirit, which the people here sell for very cheap, that for one *pie* (about a half-penny) may be purchased no less than a *cutchafer* (above a pint English) with which any man may get completely drunk. These flowers make an article of trade; being exported from this country to Patna and elsewhere in no inconsiderable quantities.

The oil yielded by the fruit, as before mentioned, resembles ghee so much, that, being cheaper, the natives often mix it with that commodity. They use it the same as ghee in their victuals, and in the composition of some sorts of sweetmeats; and burn it in their lamps. It is also regarded as a salutary remedy, applied exteriorly to wounds and all cutaneous eruptions. It is at first of the consistence of common oil, but soon coagulates: after being kept for some time, it acquires a bitterish taste and rancid smell, which renders it somewhat less agreeable as an article of food: but this is an inconvenience which, by the oil being properly clarified and prepared at first, might be perhaps avoided. This oil is also exported both in its adulterated and original state to Patna and other parts of the low country.

The author does not know any purpose to which
 1 the

^{Mahwah.} the gum has ever been applied : but if found upon trial to be of use, he informs us that it might be collected in large quantities ; and that the best season for this would be in the months of March and April, about the time the flowers come out, when the tree seems to be most replete with it : such an operation, indeed, would probably diminish its produce in the fruit and flower ; but where it was sufficiently cultivated, the loss in those could be but little felt.

The wood, from what has been already said of it, cannot be expected to be often had in beams of any considerable length, so as to make it so very useful in building as it would otherwise be from its not being liable to be eat by the white ants : Mr Keir, however, told our author, that when he was at Chowfee (a village upon the Caramnassa near Buxar), he had beams of it which were to the best of his remembrance above 20 feet long : but in many other respects it is a most useful wood ; and as it is tough, and of a strong texture, it might perhaps be employed to advantage in ship-building ; in which case, if properly cultivated in many grounds that seem well adapted for it and fit for little else, it might thus in time become a valuable article in that branch at Calcutta, whither it could easily be transported during the rainy season from almost any part of these countries, by several rivers that are then sufficiently full to float it down.

The tree, it is said, though it does not refuse a rich soil, will grow in the most barren ground, even amongst stones and gravel, where there is the least appearance of a soil ; and it seems to destroy all the smaller trees and brushwood about it. It does not require much moisture, seeming to produce nearly as well in the driest as in most favourable years, and in every situation ; and is therefore admirably fitted for the convenience of the inhabitants of these hilly countries, which are peculiarly subject to long and severe droughts during the hot months.

“ Yet, notwithstanding its utility, and the immense quantity of ground that seems so well adapted to the growth of it, both here and in the neighbouring provinces of Catak, Pachet, Rotas, &c. (greatest part of which, indeed, seems fit for no other useful production) I have myself never observed (says our author), nor can I find any of my acquaintance who ever have remarked, one single tree in its infant state. We can see, every where, full grown trees in great abundance ; but, never meeting with any young plants, both I and all whom I have spoken to on the subject, are at some loss to conceive how they should have come here : neither can the country people themselves, of whom I have inquired, give any rational account of this ; although it appears pretty evident that numbers of them must have been cultivated some time or other, every village having many of them growing about it. This is a circumstance which sufficiently marks the true character of the lower order of natives in their most supine indolence and sloth ; owing chiefly, perhaps, to the ignorance and stupid rapacity of their Rajahs, Zemindars, and other landholders, and their total inattention to the welfare of those dejected wretches from whom they derive their consequence and power. Of their base indifference to the interests of those whom they thus affect to hold beneath their regard, many striking instances occurred to

^{Mahwah.} me in the course of my inquiries upon this very subject ; and it was not long ago that, asking some questions concerning the mahwah of a Zemindar in this neighbourhood, he answered, that ‘ it was the food of the poor people, and how should he know any thing about it ! ’

“ It was this strange neglect of the culture of it, and a knowledge of its uselessness (continues our author), which first led me to enquire into the nature of this tree, from which the bulk of the people hereabouts already draw such great benefit, in order to know whether they might not increase it without any great trouble to themselves ; and whether thereby the revenue might not also be increased, and a certain provision be made against famines, from which the natives often suffer severely in these higher districts.

“ To effect this, it would be necessary to give the Ryots every possible encouragement to raise the tree from the seeds ; but as the torpid apathy of these people, whether natural or acquired, will ever prevent their being moved to any exertion by a prospect, however alluring, of distant advantage, I apprehend the only way of bringing this about would be making the planting and raising of a certain number of mahwahs (in proportion to the value of the tenure) an article in their kaboolets or agreements.

“ The tree, as has been already observed, will grow almost any where : it ought to be sown about the beginning of the rains, either in beds (to be afterwards transplanted) or at about thirty or forty feet distance, in the ground designed for it. It is said that in seven years the trees will give flowers and fruit ; in ten, they will yield about half of their common produce ; and that in twenty years they come to their full growth ; after which, if my information be good, they will last near one hundred years. This account, I acknowledge, must necessarily be very vague and uncertain, as I never have met with a single person who appeared to have had either opportunity or inclination to observe its progress. Such, however, is what the country people say of it.

“ I am told that a good tree will easily give four pukka maunds (about three hundred weight avoirdupois) of dried flowers, which will sell here for about two rupees ; and of seeds it will afford about two maunds ; and this, of oil, will yield 26 seers pukka weight (near 60 lb.) which, in a year like this, when oil is cheap, will sell at this place for two rupees more. It is to be observed, however, that every tree will not give so much, neither are the flowers and oil so clear in any part of the hills as at Chitra ; but, allowing only a half of this or less, to be the product of each tree (though it might be rendered still much greater by the very least care and industry in the cultivation of it), within the space of 20 years a subsistence might be raised to the inhabitants, and a considerable revenue to the proprietors of the lands throughout an immense tract of country ; the greatest part of which, in its present state, is little better than a barren waste, and cannot pay one single anna to the Zemindar or the government. That such an advantage might be derived from it, may be proved by the most moderate calculation : for supposing the trees to be sown at 40 feet distance from each other, on each begah (about the third of an acre) might stand eight trees ; and

Mahwah
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Maiden.

supposing the product of each tree to be only half a rupee, there would be four rupees of annual value on a begah of ground; half of which going to the proprietor, it would thus give a far better return than the generality of the best grounds in these parts; and the labourer would have a produce, without any other trouble than that of sowing the seed, and fencing the ground whilst the trees were young; and that of annually gathering the flowers and preparing the oil when they arrive at their proper size; and they would probably begin to give a produce within less than 10 years after the sowing.

"As this tree will yield nearly its usual quantity of flowers and fruit in seasons when, for want of rain, every other crop fails; if thus cultivated, it would afford the inhabitants a sure and certain resource, under the most dreadful, and what has hitherto been to them the most destructive, of all calamities, famine. It is well known, that the rice and other sorts of grain which form the chief part of their sustenance, require a considerable degree of moisture to bring them to perfection; an unusually dry season destroys the harvest in those articles, and reduces the Ryots in general to the utmost misery; a predicament into which they could hardly fall, even in the severest dearth of grain, whilst they had plenty of the flowers and fruit of the mahwah to depend upon."

MAIA, (fab. hist.), the daughter of Atlas and Pleione. She was the mother of Mercury by Jupiter. She was one of the Pleiades, the most luminous of the seven sisters; (see *PLEIADES*). Also, a surname of Cybele.

MAIDEN, an instrument for beheading criminals.

Of the use and form of this instrument Mr Pennant gives the following account. "It seems to have been confined to the limits of the forest of Hardwick, or the 18 towns and hamlets within its precincts. The time when this custom took place is unknown; whether Earl Warren, lord of this forest, might have established it among the sanguinary laws then in use against the invaders of the hunting rights, or whether it might not take place after the woollen manufactures at Halifax began to gain strength, is uncertain. The last is very probable; for the wild country around the town was inhabited by a lawless set, whose depredations on the cloth-tenters might soon fill the efforts of infant industry. For the protection of trade, and for the greater terror of offenders by speedy execution, this custom seems to have been established, so as at last to receive the force of law, which was, 'That if a felon be taken within the liberty of the forest of Hardwick, with goods stolen out, or within the said precincts, either hand-haband, back-berand, or confession'd, to the value of thirteen-pence halfpenny, he shall, after three market-days or meeting-days within the town of Halifax, next after such his apprehension, and being condemned, be taken to the gibbet, and there have his head cut from its body.'

"The offender had always a fair trial; for as soon as he was taken, he was brought to the lord's bailiff at Halifax: he was then exposed on the three markets (which here were held thrice in a week), placed in a stocks, with the goods stolen on his back, or, if the theft was of the cattle kind, they were placed by him;

and this was done both to strike terror into others, and to produce new informations against him. The bailiff then summoned four freeholders of each town within the forest to form a jury. The felon and prosecutors were brought face to face; the goods, the cow or horse, or whatsoever was stolen, produced. If he was found guilty, he was remanded to prison, had a week's time allowed for preparation, and then was conveyed to this spot, where his head was struck off by this machine. I should have premised, that if the criminal, either after apprehension, or in the way to execution, could escape out of the limits of the forest (part being close to the town), the bailiff had no farther power over him; but if he should be caught within the precincts at any time after, he was immediately executed on his former sentence.

"This privilege was very freely used during the reign of Elizabeth: the records before that time were lost. Twenty-five suffered in her reign, and at least twelve from 1623 to 1630; after which I believe the privilege was no more exerted.

"This machine of death is now destroyed; but I saw one of the same kind in a room under the parliament-house at Edinburgh, where it was introduced by the regent Morton, who took a model of it as he passed through Halifax, and at length suffered by it himself. It is in form of a painter's easel, and about ten feet high; at four feet from the bottom is a cross bar, on which the felon lays his head, which is kept down by another placed above. In the inner edges of the frame are grooves; in these is placed a sharp ax, with a vast weight of lead, supported at the very summit with a peg; to that peg is fastened a cord, which the executioner cutting, the ax falls, and does the affair effectually, without suffering the unhappy criminal to undergo a repetition of strokes, as has been the case in the common method. I must add, that if the sufferer is condemned for stealing a horse or a cow, the string is tied to the beast, which, on being whipped, pulls out the peg, and becomes the executioner."

MAIDEN is also the name of a machine first used in Yorkshire, and since introduced into other places, for washing of linen; consisting of a tub 19 inches high, and 27 in diameter at the top, in which the linen is put, with hot water and soap, to which is adapted a cover, fitting it very closely, and fastened to the tub by two wedges; through a hole in the middle of the cover passes an upright piece of wood, kept at a proper height by a peg above, and furnished with two handles, by which it is turned backward and forward; to the lower end of this upright piece is fastened a round piece of wood, in which are fixed several pieces, like cogs of a wheel. The operation of this machine is to make the linen pass and repass quick through the water.

MAIDEN-RENT, in our old writers, a noble paid by the tenants of some manors on their marriage. This was said to be given to the lord for his omitting the custom of marcheta, whereby he was to have the first night's lodging with his tenant's wife; but it seems more probably to have been a fine for a licence to marry a daughter.

MAIDENHEAD, a town of Berks, 26 miles from London, with a stone bridge over the Thames.

Maiden,
Maiden-
head.

Malden-
head
||
Maignen.

It is governed by a high-steward, a mayor, a steward, and 10 aldermen, out of which last two bridgemasters are chosen every year. Here is a gaol both for debtors and felons. The town stands partly in the parish of Bray and partly in that of Cookham; and here is a chapel peculiar to the corporation, the minister whereof is chosen by the inhabitants, and not obliged to attend the bishop's visitation. Here are several alms-houses and charities. This town, now so considerable, did not begin to flourish till, by the building of its bridge, travellers were brought this way, who before used a ferry at that called *Babham's End*, two miles north of it. The barge pier-bridge is maintained by the corporation, for which they are allowed the tolls both over and under it. The bridge-pier divides Berks from Bucks. There is a great trade here in malt, meal, and timber, which they carry in their barges to London. As this is the great thoroughfare from thence to Bath, Bristol, and other south-west parts of England, the adjacent wood or thicket has been noted for many robberies. The market here is on Wednesdays; there are three fairs; and here are frequent horse-races.

MAIDSTONE, a town of Kent, in England, 36 miles from London, seated on the river Medway, a branch of which runs through it. It is a corporation, and sends two members to parliament. Its chief trade, besides linen-thread, which it makes to great perfection, is in hops; of which there are great plenty of plantations about the town, as well as orchards of cherries. The tide flows quite up to the town, and brings up barges, &c. of 50 or 60 tons. It has a fine stone bridge. One of the public gaols for the county is kept in this town; and the custody of weights and measures, renewed by the standard of King Henry VII. was committed to it by parliament, as being in the centre of Kent: for which reason the knights of the shire are always elected, and the courts of justice always held here, and generally the assizes. The archbishop of Canterbury is constant parson of this parish, which is his peculiar, and served by his curate. Here are four charity schools, in which are above 100 boys and girls, who are visited once a week and catechized by the minister. This is such a plentiful country, and the lands hereabouts are so rich, that London is supplied with more commodities from hence than from any market-town in England; particularly with the large bullocks that come from the Weald of Kent, which begins but six miles off; with timber, wheat, and great quantities of hops, apples, and cherries; with a sort of paving-stone, eight or ten inches square, that is exceeding durable; and with the fine white sand for glass-houses and stationers. There are so many gentlemen's seats within 10 miles, that it is rare to find a town of so much trade and business so full of gentry and good company. The market here, which is the best in the county, is on Thursday; it has another on the second Tuesday of every month, granted them by George II. in 1711; and fairs on February 13th, May 12th, June 20th (called *Garlic fair*), and October 17th. Here was a college or hospital, erected by Archbishop Boniface; and a chantry, by Archbishop Thomas Arundel, which is now the free school.

MAIENNE, a considerable, handsome, and po-

pulous town in France, with the title of a duchy; Maignan seated on a river of the same name, in W. Long. 35. N. Lat. 48. 18.

MAIGNAN (Emanuel), a religious minim, and one of the greatest philosophers of his age, was born of an ancient and noble family at Thoulouse in 1631. Like the famous Pascal, he became a complete mathematician without the assistance of a teacher; and filled the professor's chair at Rome in 1636, where, at the expense of Cardinal Spada, he published his book *De Perspectiva Horaria*. He returned to Thoulouse in 1650, and was created provincial: the king, who in 1660 entertained himself with the machines and curiosities in his cell, made him offers by Cardinal Mazarine, to draw him to Paris; but he humbly desired to spend the remainder of his days in a cloyster. He published a course of philosophy, 4 vols 8vo, at Thoulouse; to the second edition of which he added two treatises, one against the vortices of Descartes, and the other on the speaking trumpet invented by Sir Samuel Morland. He is said to have studied even in his sleep, his very dreams being employed in theorems, the demonstrations of which would awaken him with joy. He died in 1676.

MAJESTY, a title given to kings, which frequently serves as a term of distinction. The word seems composed of the two Latin words, *major* "greater," and *status* "state." The emperor is called *Sacred Majesty*, *Imperial Majesty*, and *Cæsarean Majesty*: The king of Hungary is styled *His Apostolic Majesty*. The king of Spain is termed *His most Catholic Majesty*; and the king of Portugal, *His most Faithful Majesty*. The king of France used to be called *His most Christian Majesty*; and when he treated with the emperor, the word *Sacred* was added: He is now plain *King of the French*.—With respect to other kings, the name of the kingdom is added; as *His Britannic Majesty*, *His Polish Majesty*, &c. Formerly princes were more sparing in giving titles, and more modest in claiming them: before the reign of Charles V. the king of Spain had only the title of *Highness*; and before that of Hen. VIII. the kings of England were only addressed under the titles of *Grace* and *Highness*.

Under the Roman republic, the title *Majesty* (*majestas*) belonged to the whole body of the people; and to the principal magistrates; so that to diminish or wound the majesty of the commonwealth, was to be wanting in respect to the state or to its ministers. But the power afterwards passing into the hands of a single person, the appellation of *Majesty* was transferred to the emperor and the imperial family. Pliny compliments Trajan on his being contented with the title of *Greatness*; and speaks very indignantly of those who affected that of *Majesty*. And yet this last seems to be the most modest and just title that can be attributed to sovereigns, since it signifies no more than the royalty or sovereign power.

MAI INDUCTION, an ancient custom for the priest and people of country-villages to go in procession to some adjoining wood on a May-day morning; and return in a kind of triumph, with a May-pole, boughs, flowers, garlands, and other tokens of the spring. This May-game, or rejoicing at the coming of the spring, was for a long time observed, and still is in some parts of England; but there was thought

110.

Mail
Maillet.

to be so much heathen vanity in it, that it was condemned and prohibited within the diocese of Lincoln by the good old bishop Groshead.

MAIL (*maile*), a term primarily applied to the malles or holes in net-work.

Coat of Mail. See **COAT**. It is called also a *barbergen*. Anciently they also wore shirts of mail under the waitcoat, to serve as a defence against swords and poniards. We also read of gloves of mail.

MAIL, or *Mall*, also signifies a round ring of iron; whence the play of pall-mall, from *palla* "a ball," and *maile* "the round ring through which it is to pals."

MAIL, or *Maille*, in our old writers, a small kind of money. Silver half-pence were likewise termed *mailles*, 9 Hen. V. By indenture in the mint, a pound weight of old sterling silver was to be coined into 360 sterlings or pennies, or 720 *mails* or half-pennies, or 1440 farthings. Hence the word *mail* was derived, which is now vulgarly used in Scotland to signify an annual rent.

MAIL, or *Maille*, on ship-board, a square machine composed of a number of rings interwoven net-wise, and used for rubbing off the loose hemp which remains on lines or white cordage after it is made.

MAIL is likewise used for the leather bag wherein letters are carried by the post.

MAIL-Coaches. See **COACH**.

Alien of Mails and Duties, in Scots law. See **LAW**, p. 699, § 7. and p. 712, § 20.

MAIL (Black). See **BLACK-Mail**.

MAILLA (Joseph-Anne-Marie de Moyriac de), a learned Jesuit, was born in the castle of Maillac in the Bugey, and appointed a missionary to China, whither he went in 1703. At the age of 28 he had acquired so great skill in the characters, arts, sciences, mythology, and ancient books of the Chinese, as to astonish even the learned. He was greatly beloved and esteemed by the emperor Kam-Hi, who died in 1722. He, together with other missionaries, was employed by that prince to draw a chart of China and Chinese Tartary, which was engraved in France in the year 1732. He drew likewise particular charts of some of the provinces of this vast empire; with which the emperor was so pleased, that he settled the author at his court. The great annals of China were also translated into French by Father Mailla, and his manuscript was transmitted to France in 1737. This work was published in 12 volumes quarto, under the inspection of M. Grofier, and is the first complete history of that extensive empire. The style, which was full of hyperbole and bombast, has been revised by the editor, and the speeches which extended to too great a length, and had too much sameness in them, have been omitted. Father Mailla, after having resided 45 years in China, died at Pekin on the 28th of June 1748, in the 79th year of his age. Kieu-Lung the reigning emperor paid the expences of his funeral. He was a man of a lively and gentle character, capable of the most persevering labour and the most unremitting activity.

MAILLET (Benoît de), descended from a noble family in Lorraine, was born in 1659, and appointed, at the age of 33, consul general for Egypt. He fulfilled this office for 16 years with great ability, sup-

ported the king's authority against the janizaries, and greatly extended the trade of France into that part of Africa. As a recompence for his services, the king bestowed upon him the consulship of Leghorn, which is the first and most considerable consulship in his gift. Being at last appointed in 1715 to visit the sea-ports in the Levant and on the coast of Barbary, he was so successful in the execution of his commission, that he obtained permission to retire with a considerable pension. He settled at Marseilles; where he died in 1738, in the 79th year of his age. He was a man of a lively imagination, and gentle manners; in society he was very amiable, and he possessed the strictest probity. He was fond of praise, and very anxious about the reputation of genius. During the whole of his life he paid particular attention to the study of natural history; and his principal object was to become acquainted with the origin of our globe. On this important subject he left some curious observations, which have been published in octavo under the title of *Telliamed*, which is the name de Maillet written backwards. The editor Abbé Mafcier has given to this work the form of dialogue. An Indian philosopher is introduced as explaining to a French missionary his opinion concerning the nature of the globe, and the origin of mankind: and, which is very incredible, he supposes it to have come out of the waters, and makes an abode uninhabitable by man the birthplace of the human race. His great object is to prove, that all the strata of which this globe is composed, even to the tops of the highest mountains, have come from the bosom of the waters; that they are the work of the sea, which continually retires to allow them gradually to appear. Telliamed dedicated his book to the illustrious Cyrano de Bergerac author of the imaginary "Travels to the sun and moon." In the humorous epistle which is addressed to him, the Indian philosopher informs us that these dialogues are nothing but a collection of dreams and fancies. He cannot be accused of having broken his word; but he may well be reproached with not having written them in the same style with his letter to Cyrano, and with not having displayed equal liveliness and humour. A subject the most extravagant is handled in the gravest manner, and his ridiculous opinion is delivered with all the serious air of a philosopher. Of the six dialogues which compose the work, the four first contain many curious observations truly philosophical and important: in the other two we find nothing but conjectures, fancies, and fables, sometimes amusing, but always absurd. To Maillet we are indebted also for "A Description of Egypt," collected from his memoirs by the editor of Telliamed, 1743, 4to, or in 2 vols 12mo.

MAIM, **MAIHEM**, or *Mayhem*, in law, a wound by which a person loses the use of a member that might have been a defence to him; as when a bone is broken, a foot, hand, or other member cut off, or an eye put out; though the cutting off an ear or nose, or breaking the hinder-teeth, was formerly held to be no maim. A maim by castration was anciently punished with death, and other maims with loss of member for member; but afterwards they were only punished by fine and imprisonment. It is now enacted by the statute 22 & 23 Car. II. that if any person, from malice afore-

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aforethought, shall disable any limb or member of any of the king's subjects with an intent to disfigure him, the offender, with his aiders and abettors, shall be guilty of felony without benefit of clergy; though no such attainer shall corrupt the blood, or occasion forfeiture of lands, &c.

MAIMBOURG (Louis), born at Nanci in 1610, became a Jesuit in 1626; and acquired reputation as a teacher, but yet more by the many histories which he published. The Janesmits criticized his history of Arianism, and that of the *Iconoclastes*; and his history of Calvinism, published in 1681, stirred up a violent paper-war against him, the operations whereof he left entirely to his enemies, without giving himself any trouble offensively or defensively. He was degraded by the general of the Jesuits, on account of his having declared too boldly in favour of the Gallican church against the Ultramontains. He retired into the abbey of St Victor, where he died in 1686.

He ought not to be confounded with *Theodore Maimbourg* his cousin; who embraced Calvinism, afterwards returned to the Romish church, returned back to the reformed religion, embraced Socinianism, and died at London about the year 1693, after having published some works.

MAIMONIDES (Moses), or MOSES THE SON OF MAIMON, a celebrated rabbi, called by the Jews *the eagle of the doctors*, was born of an illustrious family at Cordova in Spain, in 1131. He is commonly named *Moses Aegyptius*, because he settled in Egypt, where he spent his whole life in quality of physician to the sultan. Here he opened a school, which was soon filled with pupils from all parts; from Alexandria and Damascus especially, whose proficiency under him spread his fame all over the world. He was no less eminent in philosophy, mathematics, and divinity, than in medicine. Casaubon affirms it may be truly said of him, as Pliny of old said of Diodorus Siculus, that "he was the first of his tribe who ceased to be a trifler." It would be tedious to enumerate all the works of Maimonides; some were written originally in Arabic, but are now extant only in Hebrew translations. "Those (says Collier), who desire to learn the doctrine and the canon law contained in the Talmud, may read Maimonides's compendium of it in good Hebrew, in his book intitled *Iad*; wherein they will find great part of the fables and impertinencies in the Talmud entirely discarded. But the *Mare Nuchim* is the most valued of all his works; designed to explain the obscure words, phrases, metaphors, &c. in scripture, which, when literally interpreted, have either no meaning or appear absurd.

MAIN, an epithet usually applied by sailors to whatever is principal, as opposed to whatever is inferior or secondary. Thus the main land is used in contradistinction to an island, or peninsula; and the main-mast, the main-wale, the main-keel, and the main-hatchway, are in like manner distinguished from the fore and mizen masts, the channel-wales, the false keel, and the fore and after hatchways, &c.

MAINOUR, MANOUR, or *Meinour* (from the French *manier*, i. e. *manu tradere*), in a legal sense denotes the thing that a thief taketh away or stealth: As to be taken with the mainour (*Pl. Cor. fol. 179.*),

is to be taken with the thing stolen about him: And again (*fol. 194.*) it was presented, that a thief was delivered to the sheriff or vicount, together with the mainour: And again (*fol. 186.*), if a man be indicted, that he feloniously stole the goods of another, where, in truth, they are his own goods, and the goods he brought into the court as the mainour; and if it be demanded of him, what he saith to the goods, and he disclaim them; though he be acquitted of the felony, he shall lose the goods: And again (*fol. 149.*), if the defendant were taken with the manour, and the manour be carried to the court, they, in ancient times, would arraign him upon the manour, without any appeal or indictment. Cowel. See Blackst Comment. Vol. III. 71. Vol. IV. 303.

MAINPRIZE. See *Fals Imprisonment*.

The writ of mainprize, *maincapias*, is a writ directed to the sheriff (either generally, when any man is imprisoned for a bailable offence, and bail hath been refused; or specially, when the offence or cause of commitment is not properly bailable below), commanding him to take sureties for the prisoner's appearance, usually called *mainpernors*, and to set him at large. Mainpernors differ from bail, in that a man's bail may imprison, or surrender him up before the stipulated day of appearance; mainpernors can do neither, but are barely sureties for his appearance at the day: bail are only sureties that the parties be answerable for the special matter for which they stipulate, mainpernors are bound to produce him to answer all charges whatever. See *HABEAS Corpus*.

MAINTENANCE, in law, bears a near relation to BARRETRY; being an officious intermeddling in a suit that no way belongs to one, by maintaining or assisting either party with money or otherwise, to prosecute or defend it: a practice that was greatly encouraged by the first introduction of uses. This is an offence against public justice, as it keeps alive strength and contention, and prevents the remedial process of the law into an engine of oppression. And therefore, by the Roman law, it was a species of the *crimen falsi*, to enter into any confederacy, or do any act to support another's law-suit, by money, witnesses, or patronage. A man may, however, maintain the suit of his near kinsman, servant, or poor neighbour, out of charity and compassion, with impunity. Otherwise the punishment by common law is fine and imprisonment; and by the statute 32 Hen. VIII. c. 9, a forfeiture of 10l.

MAINTENON (Madame de), a French lady of extraordinary fortune, descended from an ancient family, and whose proper name was *Frances Daubigne*, was born in 1635. Her parents by misfortunes being ill able to support her, she fell to the care of her mother's relations; to escape which state of dependence, she was induced to marry that famous old buffoon the Abbé Scarron, who subsisted himself only on a pension allowed him by the court for his wit and parts. She lived with him many years, which Voltaire makes no scruple to call the happiest years of her life; but when he died in 1660, she found herself as indigent as she was before her marriage. Her friends indeed endeavoured to get her husband's pension continued to her, and presented so many petitions to the king about it, all beginning with "The widow Scarron most humbly

Mair-prize
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Maintenon.

Major.

prays your majesty's, &c." that he was quite weary of them, and has been heard to exclaim, "Must I always be pestered with the widow Scarron?" At last, however, through the recommendation of Madame de Montepan, he settled a much larger pension on her, with a genteel apology for making her wait so long; and afterward made choice of her to take care of the education of the young duke of Maine, his son by Madame de Montepan. The letters she wrote on this occasion charmed the king, and were the origin of her advancement; her personal merit effected all the rest. He bought her the lands of Maintenon, the only estate she ever had; and finding her pleased with the acquisition, called her publicly *Madam de Maintenon*; which was of great service to her in her good fortune, by releasing her from the ridicule attending that of Scarron. Her elevation was to her only a retreat; the king came to her apartment every day after dinner, before and after supper, and continued there till midnight: here he did business with his ministers, while Madame de Maintenon, employed in reading or needlework, never showed any desire to talk of state-affairs, and carefully avoided all appearance of cabal or intrigue; she did not even make use of her power to dignify her own relations. About the latter end of the year 1685, Louis XIV. married her, he being then in his 48th and she in her 50th year; and that piety with which he inspired the king to make her a wife instead of a mistress, became by degrees a settled disposition of mind. She prevailed on Louis to found a religious community at St Cyr, for the education of 300 young ladies of quality; and here she frequently retired from that melancholy of which she complains so pathetically in one of her letters, and which few ladies will suppose she should be liable to in such an elevated situation. But, as M. Voltaire says, if any thing could show the vanity of ambition, it would certainly be this letter. Madame de Maintenon could have no other uneasiness than the uniformity of her manner of living with a great king; and this made her once say to the Count Daubigné her brother, "I can hold it no longer; I wish I was dead." The answer he made to her was, "You have then a promise to marry the Almighty!" Louis, however, died before her in 1715; when she retired wholly to St Cyr, and spent the rest of her days in acts of devotion; and what is most surprising is, that her husband left no certain provision for her, recommending her only to the duke of Orleans. She would accept no more than a pension of 80,000 livres, which was punctually paid her till she died in 1719. A collection of her letters has been published, and translated into English; from which familiar intercourses her character will be better known than from description.

MAJOR, in the art of war, the name of several officers of very different ranks and functions.

Major-general. See GENERAL.

Major of a Regiment of Foot, the next officer to the lieutenant-colonel, generally promoted from the eldest captain: he is to take care that the regiment be well exercised, to see it march in good order, and to rally it in case of being broke in action: he is the only officer among the infantry that is allowed to be on horseback in time of action, that he may the more readily execute the colonel's orders.

Major of a Regiment of Horse, as well as foot, ought N^o 192.

to be a man of honour, integrity, understanding, courage, activity, experience, and address: he should be master of arithmetic, and keep a detail of the regiment in every particular: he should be skilled in horsemanship, and ever attentive to his business: one of his principal functions is, to keep an exact roster of the officers for duty: he should have a perfect knowledge in all the military evolutions, as he is obliged by his post to instruct others, &c.

Town-Major, the third officer in order in a garrison, and next to the deputy-governor. He should understand fortification, and has a particular charge of the guards, rounds, patrols, and sentinels.

Brigade-Major, is a particular officer appointed for that purpose only in camp: he goes every day to head-quarters to receive orders from the adjutant-general: there they write exactly whatever is dictated to them: from thence they go and give the orders, at the place appointed for that purpose, to the different majors or adjutants of the regiments which compose that brigade, and regulate with them the number of officers and men which each are to furnish for the duty of the army; taking care to keep an exact roster, that one may not give more than another; and that each march in their tour: in short, the major of brigade is charged with the particular detail in his own brigade, in much the same way as the adjutant-general is charged with the general detail of the duty of the army. He sends every morning to the adjutant-general an exact return, by battalion and company, of the men of his brigade missing at the retreat, or a report expressing that none are absent: he also mentions the officers absent with or without leave.

As all orders pass through the hands of the majors of brigade, they have infinite occasions of making known their talents and exactness.

Major of Artillery, is also the next officer to the lieutenant-colonel. His post is very laborious, as the whole detail of the corps particularly rests with him; and for this reason all the non-commissioned officers are subordinate to him, as his title of *serjeant-major* imports: in this quality they must render him an exact account of every thing which comes to their knowledge, either regarding the duty or wants of the artillery and foldiers. He should possess a perfect knowledge of the power of artillery, together with all its evolutions. In the field he goes daily to receive orders from the brigade-major, and communicates them with the parole to his superiors, and then dictates them to the adjutant. He should be a very good mathematician, and be well acquainted with every thing belonging to the train of artillery, &c.

Major of Engineers, commonly with us called *Sub-directors*, should be very well skilled in military architecture, fortification, gunnery, and mining. He should know how to fortify in the field, to attack and defend all sorts of posts, and to conduct the works in a siege, &c. See ENGINEER.

Adj-Major, is on sundry occasions appointed to act as major, who has a pre-eminence above others of the same denomination. Our horse and foot-guards have their guidons, or second and third majors.

Serjeant-Major, is a non-commissioned officer, of great merit and capacity, subordinate to the adjutant as he is to the major. See SERJEANT.

Drum-Major, is not only the first drummer in the regiment

Major.

Major. regiment, but has the same authority over his drummers as the corporal has over his squad. He instructs them in their different beats; is daily at orders with the sergeants, to know the number of drummers for duty. He marches at their head when they beat in a body. In the day of battle, or at exercise, he must be very attentive to the orders given him, that he may regulate his beats according to the movements ordered.

Rife-Majors, is he that plays the best on that instrument, and has the same authority over the fifers as the drum-major has over the drummers. He teaches them their duty, and appoints them for guards, &c.

Major, in law, a person who is of age to manage his own affairs. By the civil law a man is not a major till the age of 25 years; in England, he is a major at 21, as in Normandy at 20.

Major, in logic, is understood of the first proposition of a regular syllogism. It is called *major*, because it has a more extensive sense than the minor proposition, as containing the principal term. See **LOGIC**.

Major and *Minor*, in music, are applied to concords which differ from each other by a semi-tone. See **CONCORD**.

Major-tene is the difference between the fifth and fourth; and major semi-tone the difference between the major fourth and the third. The major tone surpasses the minor by a comma.

Mayor-Domo, an Italian term, frequently used to signify a steward or master of the household. The title of *major domo* was formerly given in the courts of princes to three different kinds of officers. 1. To him who took care of what related to the prince's table, or eating; otherwise called *elater*, *præfessus mensæ*, *archibuticulus*, *dispenser*, and *princeps coquorum*.—2. *Major-domo* was also applied to the steward of the household.—3. The title of *major-domo* was also given to the chief minister, or him to whom the prince deputed the administration of his affairs, foreign and domestic, relating to war as well as peace. Instances of *major-domos* in the two first senses are frequent in the English, French, and Norman affairs.

MAJOR (John), a scholastic divine and historian, was born at Haddington, in the province of East Lothian in Scotland. It appears from some passages in his writings, that he resided a while both at Oxford and Cambridge. He went to Paris in 1493, and studied in the college of St Barbe, under the famous John Boulae. Thence he removed to that of Montacute, where he began to study divinity under the celebrated Standonk. In the year 1498, he was entered of the college of Navarre. In 1505, he was created doctor in divinity; returned to Scotland in 1519, and taught theology during several years in the university of St Andrew's. But at length, being disgusted with the quarrels of his countrymen, he went back to Paris, and resumed his lectures in the college of Montacute, where he had several pupils, who afterwards became men of great eminence. About the year 1530, he returned once more to Scotland, and was chosen professor of theology at St Andrew's, of which he afterwards became provost; and there died in 1547, aged 78. His logical treatises form one immense folio; his commentary on Aristotle's physics makes another; and his theological works amount to several volumes of the same size. These masses of crude and useless disqui-

sition were the admiration of his cotemporaries. A work, less prized in his own age, was to make him known to posterity. His book *De Gestis Sotorum*, was first published at Paris by Badius Ascensius, in the year 1521. He rejects in it some of the fictions of former historians; and would have had greater merit if he had rejected more. He intermingles the history of England with that of Scotland; and has incurred the censure of some partial writers, for giving an authority to the authors of the former nation, which he refuses to those of his own. Bede, Caxton, and Froissard, were exceedingly useful to him. What does the greatest honour to this author is, the freedom with which he has censured the rapacity and indolence of ecclesiastics, and the train of ridicule with which he treats the pope's supremacy. The style in which he wrote does not deserve commendation. Bishop Spotiswood calls it *Sorbonnic* and *barbarous*.

MAJORCA, an island of the Mediterranean, lying between Yvica on the west and Minorca on the east. These three islands were anciently called *Balears*, supposed to be from the skill of their inhabitants in slinging, for which they were very remarkable. Originally they belonged to the Carthaginians; but during the wars of that people with the Romans, they seem to have regained their liberty. In 122 B. C. they were subdued by Metellus the Roman consul, who treated the inhabitants with such cruelty, that out of 30,000 he scarce left 1000 alive. He then built two cities on Majorca; one called *Palma*, now *Majorca*, to the east; the other to the west, named *Pollentia*, now no longer in being. The island continued subject to the Romans, and to the nations who over-ran the western part of the empire, for many ages. At last it was subdued by the Moors about the year 800. By them the island was put in a much better condition than it ever was before or since. The Moors being very industrious, and also populous, surrounded the whole coast with fortifications, that is, with a kind of towers and lines between them; cultivated every spot in the island that was not either rock or sand; and had no fewer than 15 great towns, whereas now there are not above three. Neither was it at all difficult for the Moorish monarch to bring into the field an army much superior in number to the inhabitants that are now upon it, taking in all ranks, sexes, and ages. In 1229, the island was subdued by the king of Arragon, who established in it a new kingdom, feudatory to that of Arragon, which was again destroyed in 1341 by the same monarchs; and ever since, the island hath been subject to Spain, and hath entirely lost its importance. It is about 60 miles long, and 45 broad. The air is clear and temperate, and, by its situation, the heat in summer is so qualified by the breezes, that it is by far the most pleasant of all the islands in the Mediterranean. There are some mountains; but the country is generally flat, and of such an excellent soil, that it produces great quantities of corn as good in its kind as any in Europe. Oil, wine, and salt, are very plentiful, as also black cattle and sheep; but deer, rabbits, and wild-fowl, abound so much, that they alone are sufficient for the subsistence of the inhabitants. There are no rivers, but a great many springs and wells, as well as several good harbours. The inhabitants are robust, active, and good seamen.

Majorca,
Mairan.

MAJORCA, a handsome, large, rich, and strong town, in the island of the same name, with a bishop's see. It contains about 6000 houses, and 22 churches, besides the cathedral. The squares, the cathedral, and the royal palace, are magnificent structures. A captain-general resides there, who commands the whole island; and there is a garrison against the incursion of the Moors. It was taken by the English in 1706; but was retaken in 1715, since which time it has been in the hands of the Spaniards. It is seated on the south-west part of the island, where there is a good harbour, 70 miles north-east of Yvica, 120 south-east of Barcelona, 140 east of Valencia, and 300 from Madrid. E. Long. 2. 55. N. Lat. 39. 36.

MAIRAN (Jean-Jacques d'Ortous de), descended from a noble family at Biers, was born in that city in 1678, and died at Paris of a distillation of the lungs on the 20th of February 1771, at the age of 93. He was one of the most illustrious members of the academy of sciences and of the French academy. Being early connected with the former society, he, in the year 1741, succeeded Fontenelle in the office of secretary. This station he filled with the most distinguished success till the year 1744; and, like his predecessor, possessed the faculty of placing the most abstract subjects in the clearest light; a talent which is very rare, but which appears conspicuous in all his works. The chief of them are, 1. *Dissertation sur la Glace*, the last edition of which was printed in 1749, 12mo. This excellent little tract has been translated into German and Italian. 2. *Dissertation sur la cause de la lumière des Phosphores*, 1717, 12mo. 3. *Traité historique & physique de l'Aurore Boréale*, first published in 12mo 1733, and afterwards much enlarged and printed in 4to in 1754. The system embraced by the author is liable to be controverted; but the book displays great taste and erudition. 4. *Lettre au Pere Parennin, contenant diverses questions sur la Chine*, 12mo. This is a very curious work, and is full of that philosophical spirit which characterises the author's other publications. 5. A great number of papers in the memoirs of the academy of sciences (since 1719), of which he published some volumes. 6. Several Dissertations on particular subjects, which form only small pamphlets. 7. *The Eloges of the Academicians of the Academy of Sciences*, who died in 1741, 1742, 1743, in 12mo. 1747. Without imitating Fontenelle, the author attained almost equal excellence by his talent of discriminating characters, appreciating their worth, and giving them their due share of praise, without at the same time concealing their defects.

Mairan's reputation extended itself into foreign countries. He was a member of the imperial academy at Peterburgh, of the royal academy of London, of the institution at Bologna, of the royal societies of Edinburgh and Upsal, &c. The gentleness and sweetness of his manners made him be considered as a perfect model of the social virtues. He possessed that amiable politeness, that agreeable gaiety, and that steady firmness, which never fail to procure love and esteem. But we must add, says M. Saverien, that every thing had a reference to himself; self-love and a regard to his own reputation were the motives of all his actions. He was deeply affected with censure or

Maire,
Maistre.

applause, and yet he had many friends. Uniting much gentleness of disposition to an ingenious and agreeable expression of countenance, he possessed the art of insinuating himself into the good graces of others, so as to have the way to elevation and success. He was honoured with protection and particular marks of regard by the duke of Orleans the regent, who bequeathed to him his watch in his will. The prince of Conti loaded him with favours; and the chancellor Dagueffeau, observing in him great originality and ingenuity of thought, appointed him president of the *Journal des Savans*; a station which he filled very much to the satisfaction of the public and of the learned. The private and selfish views imputed to him by M. Saverien never made him deficient in what was due to the strictest probity. An expression of his is remembered, which could have proceeded only from sentiment; "An honest man (said he) is one whose blood is refreshed with the recital of a good action." He was ready at repartee. One day he happened to be in company with a gentleman of the gown, and to differ with him in opinion upon some point which had no more connection with jurisprudence than with geometry. "Sir (said the magistrate, who supposed that a learned man was a perfect idiot out of his own sphere), we are not now talking of Euclid or Archimedes!"—"No, nor of Cujas nor Bartholæ!" replied the academician.

MAIRE (Streights le), a passage to Cape Horn, situated between Terra del Fuego and Staten island, which, being discovered by Le Maire, obtained his name. It is now, however, less made use of than formerly, ships going round Staten Island as well as Terra del Fuego.

MAISTRE (Louis-Isaac le), better known by the name of Sacy, was born at Paris in 1613. His genius very early discovered itself. After an excellent course of study under the direction of the abbot of saint Cyran, he was raised to the priesthood in 1648, and soon after was chosen, on account of his virtues, to be director of the religious of Port Royal des Champs. As this monastery bore the reputation of Janfenism, their enemies were furnished with a pretence for persecuting them. In 1661 the director was obliged to conceal himself; and in 1666 he was committed to the Bastille. During his confinement he composed the book *Figures de la Bible*; in which, according to the Molinists, allusions are made to the sufferings endured by the Janfenists. If we may believe a Jesuit writer, the gentlemen of Port Royal and those who opposed their errors are represented in the 92d figure, the former by David, the latter by Saul. Rehoboam in the 116th figure, Jeezebel in the 130th, Ahasuerus in the 148th and 150th, and Darius in the 160th, in the opinion of this author, represent Louis XIV. The writer of these anecdotes, of which we do not answer for the authenticity, adds, that when Sacy wished to reproach his persecutors, he always did it by means of the holy fathers. If this is the key to those enigmatical portraits and allusions, which it is pretended are to be found in that book, certain we are it was not discovered by the spirit of charity. Besides, it is not certain that Sacy was the author of that book; for it is much more probable that

Maitre, Maitland. that it was composed by Nicolas Fontaine his fellow prisoner.

To Sacy's confinement the public are indebted for a French translation of the Bible. This work was finished in 1668, the evening before the feast of All Saints; on which day he recovered his liberty, after an imprisonment of two years and a half. He was presented to the king and the minister; and all the favour he asked from them was, that they would send several times a year to examine the state of the prisoners in the Bastille. Le Maitre continued at Paris till 1675, when he retired to Port-Royal, which he was obliged to leave in 1679. He went to settle at Pomponne, where he died January 4th 1684, at the age of 71. From him we have 1. *La Traduction de la Bible*, with explanations of the spiritual and literal meaning taken from the fathers, the greater part of which was done by du Fosse, Huré, and Tournoux. This is the best French translation which has yet appeared, and the most esteemed edition is that of Paris in 32 volumes 8vo, 1682 and following years. The author translated the New Testament three times, because the first time the style of it appeared too much laboured and too refined, and the second too simple. A counterfeited of the edition in 32 vols 8vo, was published at Brussels in 40 vols 12mo. The best editions of this version have been published at Brussels, 1700, in 3 vols 4to; at Amsterdam, under the name of Paris, 1711, 8 vols in 12mo; at Paris 1713, in 2 vols 4to; and in 1715, with notes and a concordance, 4 vols folio. 2. *Une Traduction des Pseaumes selon l'Hebreu & la Vulgate*, in 12mo. 3. *Une Version des Homelies de St Chrysostome sur St Matthieu*, in 3 vols 8vo. 4. *La Traduction de l'Imitation de Jesus Christ (sous le nom de Beuil, prieur de Saint-Pal)*, Paris 1663, 8vo. 5. *Celle de Phedre*, 12mo. (sous le nom de Saint-Aubin). 6. *De trois Comedies de Terence*, in 12mo. 7. *Des Lettres de Bongars (sous le nom de Brianville)*. 8. *Du Poeme de St Prosper sur les ingrates*, in 12mo. en vers & en prose. 9. *Les Enluminures de l'Almanach des Jesuites*, 1654, 12mo. reprinted in 1733. In 1653 there appeared a print representing the overthrow of Janesism anathematized by the two powers, and the confusion of the disciples of the bishop of Ypres, who are going to seek refuge with the Calvinists. The monks of Port-Royal were greatly provoked at this print, and Sacy thought that he would lower its reputation by means of his *Enluminures*, which Racine has ridiculed in one of his letters. It is indeed very strange that men of taste and piety should write satires to the injury of one another. 10. *Heures de Port-Royal*, in 12mo. 11. *Lettres de Pieté*, Paris 1690, 2 vols 8vo.

MAITLAND (Sir Richard), a Scottish poet and eminent public character, who flourished during the greatest part of the 16th century. The ancient name of the family was *Mautalant*; and the first who distinguished the house was an old Sir Richard, famous for his valour, who lived some time subsequent to the middle of the 13th century. He was then baron or laird of Thirlstane in Haddingtonshire. In 1346 the family must have been eminent; for in that year John Maitland of Thirlstane married Agnes daughter of Patrick earl of March. On the 28th January 1432, William Maitland of Thirlstane obtained from Archibald duke of Touraine and earl of Douglas a grant of

the lands of Blyth and others—William, the father of Maitland our poet, and who (while his father John Maitland of Thirlstane was yet alive) first had the title of Lethington, married Martha daughter of George Lord Seaton, and was killed at Flodden in 1513.

Sir Richard was born in 1496; was educated at St Andrew's; and went to France to study the laws. Upon his return, says Mackenzie, he became a favourite of James V. and in the books of feudrent is marked an extraordinary lord of session in 1533. By a letter of James VI. it appears that Sir Richard had served his grandfater, goodfater, his mother, and himself, faithfully in many public offices. He unhappily became blind before 1561, or his 65th year: but notwithstanding, he was made a senator of the college of justice, by the title of Lord Lethington, 12th Nov. 1561; and on the 20th Dec. 1562, one of the counsell and lord-privy seal; which last office he held till 1567, when he resigned it in favour of John his second son. Sir Richard continued a lord of session during all the troublesome times of the regents in the minority of James VI. till 1584, when he resigned; and died 20th March 1586. By Mary his wife, daughter of Thomas Cranston of Corlly, he had seven children, of whom three were sons: 1. William, the famous secretary; 2. Sir John, afterward Lord Thirlstane and chancellor; and, 3. Thomas, who is the prolocutor with Buchanan in his treatise *De Jure Regni*.—Sir Richard is never mentioned by writers but with respect as a man of great talents and virtue. Knox indeed blames him for taking a sum of money, to suffer Cardinal Beaton to escape when imprisoned at Seaton. But Knox (Mr Pinkerton observes) was too vehement, and often blamed without cause.—One poem of Sir Richard's was published in the Evergreen; but no more of his works appeared till they were inserted in the Collection in 2 vols published some years ago by Mr Pinkerton. Besides poems, he wrote a MS. (formerly, as Dr Mackenzie shows, in the earl of Winton's library), the title of which was, "The Chronicle and Historie of the House and Surname of Seaton, unto the moneth of November, in the year of God An Thufand Five Hundereth Fifty Aught yeirs. Collected, writ, and set furth, be Sir Richard de Maitland of Leithingtown, knight, daughter-son of the said house." Mackenzie gives an account of it.—Mr Forbes, in the preface to his Decisions, tells us there is still a MS. of the decisions from 13th December 1550 till 30th July 1565 by our author, folio, in the advocates library.

MAITLAND (John), Lord Thirlstane, chancellor of Scotland, was the second son of Sir Richard. He was born in the year 1537, educated in Scotland, and was afterwards sent to France to study the law. On his return to his native country, he commenced advocate; in which profession his abilities became eminently conspicuous. In 1567, his father resigned the privy-seal in his favour. This office he kept till 1570; when, for his loyalty to the queen, he lost the seal, and it was given to George Buchanan. He was made a senator of the college of justice, or lord of session, in 1581; secretary of state in 1584; and lord high chancellor in 1586. The chancellor's power and influence created him many enemies among the Scottish nobility, who made several attempts to destroy him.

Maitland,
Maittaire.

but without success. In 1589, he attended the king on his voyage to Norway, where his bride, the princess of Denmark, was detained by contrary wind. The marriage was immediately consummated; and they returned with the queen to Copenhagen, where they spent the ensuing winter. During their residence in Denmark, the chancellor became intimately acquainted with the celebrated Tycho-Brahe. In 1590 he was created Lord Maitland of Thirlstane—Towards the end of the year 1592, the chancellor incurred the queen's displeasure, for refusing to relinquish his lordship of Muffelburgh, which she claimed as being a part of Dunfermline. He absented himself for some time from court; but was at length restored to favour, and died of a lingering illness in the year 1595, much regretted by the king. He bears a high character both for talents and integrity among all historians. Melville, who writes the *Memoirs*, Mr Pinkerton observes, was his personal enemy, to must not receive much credit in his censures of him. Beside his Scottish poetry in the *Maitland Collection*, he wrote several Latin epigrams, &c. to be found in the *Deliciae Poetarum Scotorum*, vol. ii. The chancellor's only son, John Lord Thirlstane, was first made viscount and then earl of Lauderdale, by James VI. 1624. The earl's son was John, the only duke of Lauderdale, and born 1616 at Lethington.

MAITTAIRE (Michael), an eminently learned writer, was born in 1668. Dr South, canon of Christ-Church, made him a student of that house, where he took the degree of M. A. March 23. 1696. From 1695 till 1699 he was second master of Westminster school; which was afterwards indebted to him for *Græce Linguae Dialecti, in usum Scholæ Westmonasteriensis*, 1706, 8vo; and for "The English Grammar, applied to, and exemplified in, the English Tongue, 1712," 8vo. In 1711, he published "Remarks on Mr Whiston's Account of the Convocation's proceedings with relation to himself, in a Letter to the right reverend Father in God George Lord Bishop of Bath and Wells," 8vo.; also "An Essay against Arianism, and some other Heresies; or a Reply to Mr William Whiston's Historical Preface and Appendix to his Primitive Christianity revived," 8vo. In 1709 he gave the first specimen of his great skill in typographical antiquities, by publishing *Stephanorum Hylori, vitas ipsorum ac libros complens*, 8vo; which was followed in 1717 by *Historia Typographorum aliquot Parisiensium, vitas et libros complens*, 8vo. In 1719, *Annales Typographici ab artis inventæ origine ad annum MD*, 4to. The second volume, divided into two parts, and continued to the year 1536, was published at the Hague in 1702; introduced by a letter of John Toland, under the title of *Conjectura verisimilis de prima Typographia Inventione*. The third volume, from the same press in two parts, continued to 1557, and (by an Appendix) to 1664, in 1725. In 1733 was published at Amsterdam what is usually considered as the fourth volume, under the title of *Annales Typographici*

ab artis inventæ origine, ad annum MDCLIX, opera Mich. Maittaire, A. M. Editio nova, auctior et emendatior, tomis primi pars posterior (A). In 1741 the work was clofed at London, by *Annalium Typographicorum Tomus quintus et ultimus, indicem in tomis quatuor prævinctis complens*; divided, like the two preceding volumes, into two parts. In the intermediate years, Mr Maittaire was diligently employed on various works of value. In 1713 he published by subscription *Opera et Fragmenta Veterum Poëtarum*, 1713, two volumes in folio: the title of some copies is dated 1721. In 1714, he was the editor of a Greek Testament, in 2 vols. The Latin writers, which he published separately, most of them with good indexes, came out in the following order: In 1713, *Christi Patiens; Justin; Lucretius; Phadrus; Sallust; Terence*. In 1715, *Caullus; Tibullus; Propertius; Cornelius Nepos; Florus; Horace; Juvenal; Ovid*, 3 vols; *Virgil*. In 1711, *Cæsar's Commentaries; Martial; Quintus Curtius*. In 1718 and 1725, *Pelleus Patroclus*. In 1719, *Lucan*. In 1720, *Bonifontii Carmina*. In 1711 he published, *Batrachomyomachia Græce ad veterum exemplarium fidem recusa; Glossa Græca; variantibus lectionibus, versionibus Latinis, commentariis et indicibus illustrata*, 8vo. In 1722, *Miscellanea Græcorum aliquot Scriptorum Carmina, cum versione Latina et Notis*, 4to. In 1724 he compiled, at the request of Dr John Freind (at whose expence it was printed), an Index to the works of *Aræteus*, to accompany the splendid folio edition of that author in 1723. In 1725 he published an excellent edition of *Anacreon* in 4to, of which no more than 100 copies were printed, and the few errata in each copy corrected by his own hand. A second edition of the like number was printed in 1741, with six copies on fine writing paper. In 1726 he published *Petri Petii Medici Parisiensis in tres priores Arætei Capadocis Libros Commentarii, nunc primum editi*, 4to. This learned commentary was found among the papers of Grævius. From 1728 to 1733 he was employed in publishing *Marmorum Arundelianorum, Saldanianorum, aliorumque Academiae Oxoniensis donatorum, una cum Commentariis et Indice, editio secunda*, folio; to which an Appendix was printed in 1733. *Epistola D. Mich. Maittaire ad D. P. Des Maizeaux, in qua Indici in Annales Typographicos methodus explicatur*, &c. is printed in "The Present State of the Republic of Letters," August 733, p. 142. The life of Robert Stephens in Latin, revised and corrected by the author, with a new and complete list of his works, is prefixed to the improved edition of R. Stephens's *Thesaurus*, 4 vols in folio, in 1734. In 1736 appeared *Antique Inscriptions duæ, folio*; being a commentary on two large copper tables discovered near Heraclea, in the Bay of Tarentum. In 1738 were printed at the Hague *Græce Linguae Dialecti in Scholâ Regiâ Westmonasteriensis usum recogniti opera Mich. Maittaire*. In 1739 he addressed to the empress of Russia a small Latin poem, under the title of *Carmen Epinicum Augustissima Russorum Imperatrici sacrum*. His name not having been printed in the title-page, it

(A) The awkwardness of this title has induced many collectors to dispose of their first volume, as thinking it superseded by the second edition: but this is by no means the case; the volume of 1719 being equally necessary to complete the set as that of 1733, which is a revision of all the former volumes. The whole work, when properly bound, consists, *ad libitum*, either of five volumes or of nine.

Maize
||
Malacca.

it is not so generally known that he was editor of Plutarch's *Apophthegmata*, 1741, 4to. The last publication of Mr Maittaire was a volume of poems in 4to, 1742, under the title of *Senilia, five Poetica aliquot in argumentis varii generis tentamina*. Mr Maittaire died in 1747, aged 79. His valuable library, which had been 50 years collecting, was sold by auction by Messrs Cook and Langford, at the close of the same year, and the beginning of the following, taking up in all 44 nights. Mr Maittaire, it may be added, was patronised by the first earl of Oxford, both before and after that gentleman's elevation to the peerage, and continued a favourite with his son the second earl. He was also Latin tutor to Mr Stanhope, the earl of Chesterfield's favourite son.

MAIZE, or INDIAN CORN. See ZEA.

MAKI. See LEMUR.

MALABAR, the name given to a great part of the west coast of the peninsula, on this side of the Ganges, from the kingdom of Baglata to Cape Comorin, or only from the north extremity of the kingdom of Canara as far as Cape Comorin. It is bounded by the mountains of Balligate on the east; by Decan on the north; and on the west and south is washed by the Indian sea.

MALACA (anc. geog.), surnamed *Federatorum* by Pliny; a maritime town of Bactia: A Carthaginian colony according to Strabo; so called from *Malach*, signifying "salt;" a place noted for pickled or salted meat. Now *Malaga*, a port town of Granada in Spain. W. Long. 4. 45. N. Lat. 36. 40.

MALACCA, the most southerly part of the great peninsula beyond the Ganges, is about 600 miles in length, and contains a kingdom of the same name. It is bounded by the kingdom of Siam on the north; by the bay of Siam and the Indian ocean on the east; and by the Straits of Malacca, which separate it from the island of Sumatra, on the south-west. This country is more to the south than any other in the East Indies; and comprehends the towns and kingdoms of Patan, Pahan, Igohor, Pera, Queda, Borkelon, Ligor; and to the north the town and kingdom of Tanassery, where the Portuguese formerly carried on a great trade. This last either does or did belong to the king of Siam. The people of Malacca are in general subject to the Dutch, who possess all the strong places on the coast, and compel them to trade on their own terms, excluding all other nations of Europe from having any commerce with the natives.

The Malays are governed by feudal laws. A chief, who has the title of *king* or *sultan*, issues his commands to his great vassals, who have other vassals in subjection to them in a similar manner. A final part of the nation live independent, under the title of *oranicai* or *noble*, and sell their services to those who pay them best; while the body of the nation is composed of slaves, and live in perpetual servitude.

The generality of these people are restless, fond of navigation, war, plunder, emigrations, colonies, desperate enterprises, adventures, and gallantry. They talk incessantly of their honour and their bravery; whilst they are universally considered by those with whom they have intercourse, as the most treacherous, ferocious people on earth. This ferocity, which the Malays qualify under the name of *courage*, is so well

Malacca.

known to the European companies who have settlements in the Indies, that they have universally agreed in prohibiting the captains of their ships who may put into the Malay islands, from taking on board any seamen from that nation, except in the greatest distress, and then on no account to exceed two or three. It is not in the least uncommon for an handful of these horrid savages suddenly to embark, attack a vessel by surprise, massacre the people, and make themselves master of her. Malay batteaux, with 24 or 30 men, have been known to board European ships of 30 or 40 guns, in order to take possession of them, and murder with their poignards great part of the crew. Those who are not slaves go always armed: they would think themselves disgraced if they went abroad without their poignards, which they call *cris*. As their lives are a perpetual round of agitation and tumult, they cannot endure the long flowing garments in use among the other Asiatics. Their habits are exactly adapted to their shapes, and loaded with a multitude of buttons, which fasten them close to their bodies.

The country possessed by the Malays is in general very fertile. It abounds with odoriferous woods, such as the aloes, the sandal, and the Cassia. The ground is covered with flowers of the greatest fragrance, of which there is a perpetual succession throughout the year. There are abundance of mines of the most precious metals, said to be richer even than those of Brazil or Peru, and in some places are mines of diamonds. The sea also abounds with excellent fish, together with ambergris, pearls, and those delicate bird-nests so much in request in China, formed in the rocks with the spawn of fishes and the foam of the sea, by a species of small-sized swallow peculiar to those seas. These are of such an exquisite flavour, that the Chinese for a long time purchased them for their weight in gold, and still buy them at an excessive price. See *BIRDS-NEST*.

Notwithstanding all this plenty, however, the Malays are miserable. The culture of the lands, abandoned to slaves, is fallen into contempt. These wretched labourers, dragged incessantly from their rustic employments by their restless masters, who delight in war and maritime enterprises, have never time or resolution to give the necessary attention to the labouring of their grounds; of consequence the lands for the most part are uncultivated, and produce no kind of grain for the subsistence of the inhabitants. The fago tree indeed supplies in part the defect of grain. It is a species of the palm-tree, which grows naturally in the woods to the height of about 20 or 30 feet; its circumference being sometimes from five to six. Its ligneous bark is about an inch in thickness, and covers a multitude of long fibres, which being interwoven one with another envelope a mass of a gummy kind of meal. As soon as this tree is ripe, a whitish dust, which transpires through the pores of the leaves, and adheres to their extremities, indicates that the trees are in a state of maturity. The Malays then cut them down near the root, divide them into several sections, which they split into quarters: they then scoop out the mass of mealy substance, which is enveloped by and adheres to the fibres; they dilute it in pure water, and then pass it through a straining bag of fine cloth, in order to separate it from the fibres. When this paste has lost

Malacca
 Maaga.

part of its moisture by evaporation, the Malays throw it into a kind of earthen vessel of different shapes, where they allow it to dry and harden. Their paste is wholesome nourishing food, and preserves for many years.

MALACCA, the capital of the country of the same name, is situated in a flat country close to the sea. The walls and fortifications are founded on a solid rocky, and are carried up to a great height; the lower part of them is washed by the sea at every tide, and on the land-side is a wide canal or ditch, cut from the sea to the river, which makes it an island. In 1641 it was taken from the Portuguese by the Dutch, since which time it has continued in their possession. In this city there are a great many broad streets; but they are very badly paved. The houses are tolerably well built, and some of them have gardens behind or on one side. The inhabitants consist of a few Dutch, many Malays, Moors, Chinese, and other Indians, who are kept in awe by a fortress, which is separated from the city by a river, and by good walls and bastions, as well as by strong gates, and a draw-bridge that is on the eastern side. The city is well situated for trade and navigation. E. Long. 102. 2. N. Lat. 2. 12.

MALACHI, or the prophecy of MALACHI, a canonical book of the Old Testament, and the last of the 12 lesser prophets. Malachi prophesied about 300 years before Christ, reproving the Jews for their wickedness after their return from Babylon, charging them with rebellion, sacrilege, adultery, profaneness, and infidelity; and condemning the priests for being scandalously careless in their ministry: at the same time not forgetting to encourage the pious few, who, in that corrupt age, maintained their integrity. This prophet distinctly points at the Messiah, who was suddenly to come to his temple, and to be introduced by Elijah the prophet, that is, by John the Baptist, who came in the spirit and power of Elias, or Elijah.

MALACIA, in medicine, is a languishing disorder incident to pregnant women, in which they long sometimes for one kind of food and sometimes for another, and eat it with extraordinary greediness.

MALACOPTERYGEUS, among ichthyologists, an appellation given to such fishes as have the rays of their fins bony, but not pointed or sharp at the extremities like those of anacanthopterygeous fishes.

MALACOSTOMOUS FISHES, those destitute of teeth in the jaws, called in English *leather-mouthed*, as the tench, carp, bream, &c.

MALAGA, an ancient, rich, and strong town of Spain, in the kingdom of Grenada, with two castles, a bishop's see, and a good harbour, which renders it a place of considerable commerce. The advantage of this commerce, according to M. Bourgoanne, is entirely in favour of Spain, but almost without any to its navigation; of 842 vessels which arrived at this port in 1782, from almost every commercial nation, scarcely 100 were Spanish, even reckoning the ships of war which anchored there. The English, who are in possession of the greatest part of the trade, carry thither woollens and great quantities of small ware; the Dutch carry spice, cutlery ware, laces, ribbons, thread, &c. These nations, those of the north, and Italy, export to the amount of two millions and a

Malagrida

half of piastras in wines, fruits, sumach, pickled anchovies, oil, &c. and all they carry thither amounts only to about a million and a half. The balance would be still more advantageous for Malaga if the silk and wool of the kingdom of Grenada were exported from this port; but these are employed in the country where they are produced. The streets of Malaga are narrow, but there are some good squares; and the cathedral church is a superb building, said to be as large as St Paul's. The only other building of note is the bishop's palace; which is a large edifice, but looks insignificant from its being situated near the other. Its prelate enjoys a revenue of L.16,000 Sterling. Malaga is seated on the Mediterranean sea, at the foot of a craggy mountain. E. Long. 4. 56. N. Lat. 6. 51.

MALAGRIDA (Gabriel), an Italian Jesuit, was chosen by the general of the order to conduct missions into Portugal. To great ease and fluency of speech, for which he was indebted to enthusiasm, he added the most ardent zeal for the interest of the society to which he belonged. He soon became the fashionable director; and every one, small or great, placed himself under his conduct. He was respected as a saint, and consulted as an oracle. When a conspiracy was formed by the duke d'Aveiro against the king of Portugal, it is asserted by the enemies of the society, that three Jesuits, among whom was Malagrida, were consulted concerning the measure. They add (what is very improbable), that it was decided by these casuists, that it was only a venial crime to kill a king who persecuted the saints. At that time the king of Portugal, spurred on by a minister who had no favour for the Jesuits, openly declared himself against them, and soon after banished them from his kingdom. Only three of them were apprehended, Malagrida, Alexander, and Mathos, who were accused of having approved his murder. But either the trial could not be proceeded in without the consent of the pope, which was not granted, or no proof could be got sufficient to condemn Malagrida; and therefore the king was obliged to deliver him to the inquisition, as being suspected of having formerly advanced some rash propositions which bordered on heresy. Two publications which he acknowledged, and which gave the fullest indications of complete insanity, were the foundation of these suspicions. The one was written in Latin, and intitled *Traçatús de vita et imperio Antichristi*; the other in Portuguese, under the title of the "Life of St Anne, composed with the assistance of the blessed Virgin Mary and her most holy Son." They are full of extravagance and absurdity.—This enthusiast pretended to have the gift of miracles. He confessed before the judges of the Inquisition, that God himself had declared him his ambassador, apostle, and prophet; that he was united to God by a perpetual union; and that the Virgin Mary, with the consent of Jesus Christ and of the whole Trinity, had declared him to be her son. In short, he confessed, as is pretended, that he felt in the prison, at the age of 72, some emotions very uncommon at that period of life, which at first gave him great uneasiness, but that it had been revealed to him by God that these emotions were only the natural effect of an involuntary agitation, wherein there was the

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Malden,
Malaleuca.

fame merit as in prayer. It was for such extravagancies that this unfortunate wretch was condemned by the Inquisition: but his death was hastened by a vision which he eagerly revealed. Upon occasion of the death of the marquis de Tancourt, commander in chief of the province of Estremadura, mournful and continued discharges were made in honour of him by the castle of Lisbon, and by all the forts on the banks of the Tagus. These being heard by Malagrida in his dungeon, he instantly supposed, from their extraordinary nature, and from their happening during the night, that the king was dead. The next day he demanded an audience from the members of the Inquisition: which being granted, he told them that he had been ordered by God to show the minister of the holy office that he was not a hypocrite, as was pretended; for the king's death had been revealed to him, and he had seen in a vision the torments to which his majesty was condemned for having persecuted the religious of his order. This was sufficient to accelerate his punishment: he was burnt on the 21st of September 1761; not as the accomplice of a parricide, but as a false prophet, for which he deserved to be confined in bedlam rather than tied to the stake. The acts of impiety whereof he was accused were nothing more than extravagancies proceeding from a mistaken devotion and an overheated brain.

MALDEN, a town of Essex, 37 miles from London, situated on an eminence at the conflux of the Chelmer and Pant, or Blackwater, where they enter the sea. It was the first Roman colony in Britain, and the seat of some of the old British kings. It was besieged, plundered, and burnt by queen Boudicca; but the Romans repaired it. It was again ruined by the Danes, but rebuilt by the Saxons. It is a populous corporation, governed by two bailiffs, six aldermen, 18 headboroughs or capital-burgesses, a steward, recorder, and above 400 commonalty and burgesses, who have all a vote for its members of parliament. It has a convenient haven on an arm of the sea for vessels of 400 tons; and drives a good trade in coal, iron, corn, and deals. It formerly had three, now only two, parish-churches. Here is a large library for the use of the minister and the clergy of the neighbouring parishes, who generally reside here on account of the unwholesomeness of the air where their churches are. Here is a grammar-school, a small-church, school, and a workhouse where the poor weave sack-cloth. The custom of Borough English is kept up here. It has a market on Saturdays, and a fair on the 18th of September. A little beyond it begins Blackwater bay, famous for the Walfiet oysters. The channel called Malden-water is navigable to the town. King Edward the elder (of the Saxon race) resided here whilst he built Witham and Hertford castles. On the west side of the town are the remains of a camp.

MALALEUCA, the *CAYPUTI* TREE: A genus of the polyandria order, belonging to the polyadelphia class of plants. There is but one species, viz. the leucodendrum, a native of the East Indies and South-Sea islands. Mr Forster relates that leucodendra were found in the island of New Caledonia: they were black at the root; but had a bark perfectly white and loose, with long narrow leaves like our willows. The leaves are extremely fragrant and aromatic; and Rumphius tells

us, that from them the natives of the Moluccas make the oil called *cayputi*. This oil is commended as a nervous medicine, and as being useful in some cardialgies. The dose is four or five drops in some convenient liquor.

MALDIVIA ISLANDS, a cluster of small islands in the Indian ocean, 500 miles south-west of the continent of the island of Ceylon. They are about 1000 in number, and are very small, extending from the second degree of south latitude to the seventh degree north latitude. They are generally black low lands, surrounded by rocks and sands. The natives are of the same complexion with the Arabians, profess the Mahometan religion, and are subject to one sovereign. The channels between the islands are very narrow, and some of them are fordable. They produce neither rice, corn, nor herbage; but the natives live upon coconuts, and other fruits, roots, and fish. They have little or nothing to barter with, unless the shells called *cavarys*, or *blackmore's teeth*, with which they abound; and these serve instead of small coin in many parts of India.

MALDONAT (John), a Spanish Jesuit born in 1534, was accused of heresy, and of procuring a fraudulent will in seducing the president de St Andre at Paris to bequeath his estate to the Jesuits. Peter Gondi acquitted him of the first charge, and the parliament of Paris of the other. He retired after these troubles to Bourges, but went to Rome by order of pope Gregory XIII. to take care of the publication of the Septuagint; and there, finishing his commentary on the gospels in 1582, he died in the beginning of the following year. He wrote, besides, Commentaries on Jeremiah, Baruch, Ezekiel, and Daniel; a treatise on the sacraments, on grace, on original sin; and several other pieces printed at Paris in 1677, in folio. His style is clear, lively, and easy. He does not servilely follow the scholastic divines; but is pretty free, and sometimes singular, in his sentiments.

MALE, among zoologists, that sex of animals which has the parts of generation situated externally. See SEX and GENERATION.

The term *male* has also, from some similitude to that sex in animals, been applied to several inanimate things; thus we say, a male flower, a male screw, &c. See *Mas Planta*, *MASCULUS Flor*, and *SCREW*; also *FEMALE* and *FLOS*.

MALEBRANCHE (Nicholas), an eminent French metaphysician, the son of Nicholas Malebranche, secretary to the French king, was born in 1638, and admitted into the congregation of the oratory in 1660. He at first applied himself to the study of languages and history; but afterwards meeting with Des Cartes's *Treatise of Man*, he gave himself up entirely to the study of philosophy. In 1699, he was admitted an honorary member of the Royal Academy of Sciences at Paris. Notwithstanding he was of a delicate constitution, he enjoyed a pretty good state of health till his death, which happened in 1715, at the age of 77. Father Malebranche read little, but thought a great deal. He despised that kind of philosophy which consists only in knowing the opinions of other men, since a person may know the history of other men's thoughts without thinking himself. He could never

Maldivia
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read ten verses together without disgust. He meditated with his windows shut, in order to keep out the light, which he found to be a disturbance to him. His conversation turned upon the same subjects as his books; but was mixed with so much modesty and deference to the judgment of others, that it was extremely and universally desired. His books are famous; particularly his *Recherche de la Verité*, i. e. "Search after truth;" his design in which is, to point to us the errors in which we are daily led by our senses, imagination, and passions; and to prescribe a method for discovering the truth, which he does, by starting the notion of seeing all things in God. And hence he is led to think and speak merely of human knowledge, either as it lies in written books, or in the book of nature, compared with that light which displays itself from the ideal world; and by attending to which, with pure and defecate minds, he supposes knowledge to be most easily had. The fineness of this author's sentiments, together with his fine manner of expressing them, made every body admire his genius and abilities; but he has generally passed for a visionary philosopher. Mr Locke, in his examination of Malebranche's opinion of seeing all things in God, styles him "an acute and ingenious author;" and tells us, that there are "a great many very fine thoughts, judicious reasonings, and uncommon reflections, in his *Recherche*." But Mr Locke, in that piece, endeavours to refute the chief principles of his system. He wrote many other pieces besides that we have mentioned, all tending some way or other to confirm his main system, established in the *Recherche*, and to clear it from the objections which were brought against it, or from the consequence which were deduced from it: and if he has not attained what he aimed at in these several productions, he has certainly shown great abilities and a vast force of genius.

MALHERBE (Francis de), the best French poet of his time, was born at Caen about the year 1556, of a noble and ancient family. He quitted Normandy at 17 years of age; and went into Provence, where he attached himself to the family of Henry Angouleme, the natural son of king Henry II. and was in the service of that prince till he was killed by Altoviti in 1586. At length cardinal de Perron, being informed of his merit and abilities, introduced him to Hen. IV. who took him into his service. After that monarch's death, queen Mary de Medicis settled a pension of 500 crowns upon our poet, who died at Paris in 1628. The best and most complete edition of his poetical works is that of 1666, with Menage's remarks. Malherbe so far excelled all the French poets who preceded him, that Boileau considers him as the father of French poetry: but he composed with great difficulty, and put his mind on the rack in correcting what he wrote. He was a man of a singular humour, blunt in his behaviour, and without religion. When the poor used to promise him, that they would pray to God for him, he answered them, that "he did not believe they could have any great interest in heaven, since they were left in such a bad condition upon earth; and that he should be better pleased if the duke de Luyne, or some other favourite, had made him the same promise." He would often say that "the religion of gentlemen was that of their prince." During his last sickness

Malice,
Mallet.

he had much ado to resolve to confess to a priest; for which he gave this facetious reason, that "he never used to confess but at Easter." And some few moments before his death, when he had been in a lethargy two hours, he awaked on a sudden to reprove his laudaily, who waited on him, for using a word that was not good French; saying to his confessor, who reprimanded him for it, that "he could not help it, and he would defend the purity of the French language to the last moment of his life."

MALICE, in ethics and law, is a formed design of doing mischief to another; it differs from hatred. In murder, it is malice makes the crime; and if a man, having a malicious intent to kill another, in the execution of his malice kills a person not intended, the malice shall be connected to his person, and he shall be adjudged a murderer. The word *ex malitia præcogitata* are necessary to an indictment of murder, &c. And this *malitia præcogitata*, or *malice præpense*, may be either express or implied in law. Express malice is, when one, with a sedate, deliberate mind, and formed design, kills another; which formed design is evidenced by external circumstances discovering that intention; as lying in wait, antecedent menaces, former grudges, and concerted schemes to do him some bodily harm. Besides, where no malice is expressed, the law will imply it; as where a man wilfully poisons another, in such a deliberate act the law presumes malice, though no particular enmity can be proved. And if a man kills another suddenly, without any, or without a considerable provocation, the law implies malice; for no person, unless of an abandoned heart, would be guilty of such an act upon a slight or no apparent cause.

MALIGNANT, among physicians, a term applied to diseases of a very dangerous nature, and generally infectious; such are the dysentery, hospital-fever, &c. in their worst stages.

Malignity among physicians signifies much the same with contagion. See CONTAGION.

MALL, SEA-MALL, or *Sea-meat*, in ornithology. See LARUS.

MALLARD, in ornithology. See ANAS.

MALLEABLE, a property of metals whereby they are capable of being extended under the hammer.

MALLENDERS, in farriery. See there § xxxiv.

MALLEOLI, in the ancient art of war, were bundles of combustible materials, set on fire to give light in the night, or to annoy the enemy; when they were employed for the latter purpose they were shot out of a bow, or fixed to a javelin, and thus thrown into the enemies engines, ships, &c. in order to burn them. Pitch was always a principal ingredient in the composition. The malleoli had also the name of *pyroboli*.

MALLET or MALLOCH, (David) an English poet, but a Scotsman by birth, was born in that country about 1700. By the penury of his parents, he was compelled to be janitor of the high school at Edinburgh; but he surmounted the disadvantages of his birth and fortune; for when the Duke of Montrose applied to the college of Edinburgh for a tutor to educate his sons, Malloch was recommended. When his pupils went abroad, they were entrusted to his

Mallet.

his care; and having conducted them through their travels, he returned with them to London. Here, residing in their family, he naturally gained admission to persons of high rank and character, and began to give specimens of his poetical talents. In 1733, he published a poem on Verbal Criticism, on purpose to make his court to Pope. In 1740, he wrote a Life of Lord Bacon, which was then prefixed to an edition of his works; but with so much more knowledge of history than of science, that, when he afterwards undertook the Life of Marlborough, some were apprehensive lest he should forget that Marlborough was a general, as he had forgotten that Bacon was a philosopher. The old duchess of Marlborough assigned in her will this task to Glover and Mallet, with a reward of 1000 l. and a prohibition to insert any verses. Glover is supposed to have rejected the legacy with disdain, so that the work devolved upon Mallet; who had also a pension from the late duke of Marlborough to promote his industry, and who was continually talking of the discoveries he made, but left not when he died any historical labours behind him. When the prince of Wales was driven from the palace, and kept a separate court by way of opposition, to increase his popularity by patronizing literature, he made Mallet his under-secretary, with a salary of 200l. a year.—Thomson likewise had a pension; and they were associated in the composition of the Masque of Alfred, which in its original state was played at Cliefden in 1740. It was afterwards almost wholly changed by Mallet, and brought upon the stage of Drury Lane in 1751, but with no great success. He had before published two tragedies; Eurydice, acted at Drury Lane in 1731; and Mustapha, acted at the same theatre in 1739. It was dedicated to the prince his master, and was well received, but never was revived. His next work was Amyntor and Theodora (1747), a long story in blank verse; in which there is copiousness and elegance of language, vigour of sentiment, and imagery well adapted to take possession of the fancy. In 1753, his masque of Britannia was acted at Drury Lane, and his tragedy of Elvira in 1763; in which year he was appointed keeper of the book of entries for ships in the port of London. In the beginning of the last war, when the nation was exasperated by ill success, he was employed to turn the public vengeance upon Byng, and wrote a letter of accusation under the character of a Plain Man. The paper was with great industry circulated and dispersed; and he for his seasonable intervention had a considerable pension bestowed upon him, which he retained to his death. Towards the end of his life he went with his wife to France; but after a while, finding his health declining, he returned alone to England, and died in April 1765. He was twice married, and by his first wife had several children. One daughter, who married an Italian of rank named Cilefia, wrote a tragedy called Almida, which was acted at Drury Lane. His second wife was the daughter of a nobleman's steward, who had a considerable fortune, which she took care to retain in her own hands. His stature was diminutive, but he was regularly formed; his appearance, till he grew corpulent, was agreeable, and he suffered it to want no recommendation that

Vol. X. Part II.

Mallet.

drefs could give it. His conversation was elegant and easy.

MALLET (Edme) was born at Melun in 1713, and enjoyed a curacy in the neighbourhood of his native place till 1751, when he went to Paris to be professor of theology in the college of Navarre, of which he was admitted a doctor. Boyer, the late bishop of Mirepoix, was at first much prejudiced against him; but being afterwards undeceived, he conferred upon him the see of Verdun as a reward for his doctrine and morals. Janfenism had been imputed to him by his enemies with this prelate; and the Gazette which went by the name of *Ecclesiastical*, accused him of impiety, Eithor of these imputations was equally undeserved by the Abbé Mallet: as a Christian, he was grieved at the disputes of the French Church; and, as a philosopher, he was astonished that the government had not, from the very beginning of those dissensions imposed silence on both parties. He died at Paris in 1755, at the age of 42. The principal of his works are, 1. *Principes pour la lecture des Poètes*, 1745, 12mo. 2 vols. 2. *Essai sur l'Etude des Belles-Lettres*, 1747, 12mo. 3. *Essai sur les bienfaisances oratoires*, 1753, 12mo. 4. *Principes pour la lecture des Orateurs*, 1753, 12mo. 3 vols. 5. *Histoire des Guerres civiles de France sous les regnes de Francois II. Charles IX. Henri III. & Henry IV.* translated from the Italian of d'Avila.—In Mallet's works on the Poets, Orators, and the Belles Lettres, his object is no more than to explain with accuracy and precision the rules of the great masters, and to support them by examples from authors ancient and modern. The style of his different writings, to which his mind bore a great resemblance, was neat, easy, and unaffected. But what must render his memory estimable, was his attachment to his friends, his candour, moderation, gentleness, and modesty. He was employed to write the theological and belles-lettres articles in the *Encyclopédie*; and whatever he wrote in that dictionary was in general well composed. Abbé Mallet was preparing two important works when the world was deprived of him by death. The first was *Une Histoire generale des Guerres depuis le commencement de la Monarchie*; the second, *Une Histoire du Concile de Trente*, which he intended to set in opposition to that of Father Paul translated by Father le Courayer.

MALLET, a large kind of hammer made of wood; much used by artificers who work with a chissel, as sculptors, masons, and stone-cutters, whose mallet is ordinarily round; and by carpenters, joiners, &c. who use it square. There are several sorts of mallets used for different purposes on ship-board. The calking mallet is chiefly employed to drive the oakum into the seams of a ship, where the edges of the planks are joined to each other in the sides, deck, or bottom. The head of this mallet is long and cylindrical, being hooped with iron to prevent it from splitting in the exercise of calking. There is also the serving mallet, used in serving the rigging, by binding the spun-yarn more firmly about it than could possibly be done by hand, which is performed in the following manner: the spun-yarn being previously rolled up in a large ball or cluc, two or three turns of it are passed about the rope, and about the body of the mallet, which for

Malleville
Mallicollo

this purpose is furnished with a round channel in its surface, that conforms to the convexity of the rope intended to be served. The turns of the spun-yarn being strained round the mallet, so as to confine it firmly to the rope, which is extended above the deck, one man passes the ball continually about the rope, whilst the other, at the same time, winds on the spun-yarn by means of the mallet, whose handle acting as a lever, trains every turn about the ropes as firm as possible.

MALLEVILLE (Claud de), a French poet, born at Paris, was one of the first members of the French academy, and gained a prize from Voiture and other ingenious men. He became secretary to M. de Baisompierre, to whom he performed important services while he was in prison; and with the rewards he received for them he purchased the place of secretary to the king. He was likewise secretary to the French academy, and died in 1647. He wrote sonnets, stanzas, elegies, epigrams, songs, madrigals, and a paraphrase on some of the Psalms. His sonnets are most esteemed.

MALLICOLLO, one of the new Hebrides islands in the south-sea, and the most considerable of them all next to *Espiritu Santo*. It is 18 leagues long from south-east to north-west; its greatest breadth, which is at the south-east end, is eight leagues; the north-west end is two-thirds its breadth, and narrower in the middle one-third. This contraction is occasioned by a wide and deep bay on the south-west side. It appears to be very fertile, and well inhabited; the land on the sea coast is rather low, and lies with a greater slope from the hills which are in the middle of the island; lat. 16 deg. 28. min. south; 167 deg. 56 min. east. On inquiring of the natives the name of this island, they were answered that it was Mallicollo, which has a near resemblance to Manicollo, the name which Quiros received for it 160 years before. He did not indeed visit the island, but had his intelligence from the natives.

The south coast, which was most attentively examined by captain Cook, is luxuriantly clothed with wood and other vegetables, from the sea-shore to the very summits of the hills. To the north-west, the country is less woody, but more agreeably intersected by lawns, some of which appeared to be cultivated. The vegetable productions of this country seemed to be in great variety; cocoa nuts, bread-fruit, bananas, sugar-canes, yams, eddoes, and turmeric: but captain Cook thought the fruits here not so good as at the Society and Friendly Isles. Hogs, and common poultry, are their domestic animals; and as the frequent squeaking of pigs was heard in the woods, it was concluded that the former are in considerable numbers here. A brace of Tahitian puppies was given them, with a view to stock the country with that species of animal: these they received with strong signs of satisfaction. The woods appeared to be inhabited by many species of birds. Here was caught a shark, which measured nine feet in length, on which the ship's company feasted with great relish: this shark, when cut open, was found to have the bony point of an arrow sticking in its head, having been shot quite through the skull. The wound was healed so perfectly, that not the smallest vestige of it appeared on the outside:

a piece of the wood still remained sticking to the bony point, as well as a few fibres with which it had been tied on; but both the wood and the fibres were so rotted, as to crumble into dust at the touch. Two large reddish fish of the sea-bream kind were likewise caught, on which most of the officers and some of the petty officers dined the next day. The night following every one who had eaten of them was seized with violent pains in the head and bones, attended with a scorching heat all over the skin, and numbness in the joints; even such hogs and dogs as had partaken of these fish gave strong symptoms of being poisoned: one hog, who had eaten of the garbage, swelled to a great size, and died at night: several dogs were affected in the same manner; they groaned most piteously, had violent reachings, and could hardly drag their limbs along. These fish were supposed to have been of the same sort with those which Quiros mentions to have produced similar effects on board his ship, and which he calls *gargoi*, which is the Spanish name for the sea-bream. Perhaps these fish are not always poisonous; but, like many species in the West and East Indies, may acquire that quality by feeding on poisonous vegetables: which conclusion is supported by the circumstance of the intestines having been found to be more poisonous than the rest. The effects of this poison on the officers continued for near a fortnight, during which time their pains returned every night, their teeth were loose, and their gums and palate excoriated.

The natives of Mallicollo are described as the most ugly, ill-proportioned people imaginable, and in every respect different from the other islanders in the South-Sea: they are of a very dark colour, and diminutive size; with long heads, flat faces, and monkey countenances; their hair, in general, black or brown, short and curly, but not quite so soft and woolly as that of a negro. Their beards are very strong, crisp, and bushy, and generally black and short. But what serves greatly to increase their natural deformity is a custom which they have of wearing a belt, or cord, round their waist: this rope is as thick as a man's finger; and is tied so tight round their belly, that it would be fatal to a person unaccustomed from infancy to such an unnatural ligature; for it cuts such a deep notch across the navel, that the belly seems in a manner divided, one part going above and the other below the rope. The men go quite naked, except a piece of cloth or leaf used as a wrapper. Most other nations invent some kind of covering from motives of shame; but here a roll of cloth, continually fastened to the belt, rather displays than conceals, and is the opposite of modesty. Besides having the flat broad nose and projecting cheekbones of a negro, and a very short forehead, many increased their natural ugliness by painting their faces and breasts with a black colour. Some few had a small cap on the head made of matted-work. They wear bracelets of white and black shells, which press the upper arm so closely, that they seem to have been put on when the wearer was very young: this tends, as well as the belt, to reduce the Mallicolles to that slender shape which characterizes them. The depression of their foreheads is supposed to be artificial, as the heads of infants may be squeezed into any kind of form.

Mallicollo.

The first natives that were seen carried clubs in their hands, and waded into the water, carrying green boughs, the universal sign of peace. In a day's time they ventured to come within a few yards of the ship's boat, which was sent out; when they dipped their hands into the sea, and gathering some water in their palms, poured it on their heads. The officers in the boat, in compliance with their example, did the same, with which the Indians appeared to be much pleased. They repeated the word *tomarr*, or *tomarro*, continually; which seemed to be an expression among them equivalent to *ayo* among the Society-Islands. The greater part were now armed with bows and arrows, and a few with spears. At length they ventured near the ship, and received a few presents of Tahitian cloth, which they eagerly accepted, and handed up their arrows in exchange, some of which were pointed with wood and some with bone, and daubed with a black gummy stuff which was supposed to be poisoned; but its effects were tried on a dog, without producing any dangerous symptoms. They continued about the ship, talking with great vociferation, but at the same time in such a good-humoured manner as was very entertaining. On looking steadily at one of them, he began to chatter with great fluency, and "grinned horribly a ghastly smile." Some continued about the ship till midnight; finding, however, at length, that they were but little noticed, for the captain wanted to get rid of them, they returned on shore, where the sound of singing and beating their drums was heard all night. Mr Forster supposes there may be 50,000 inhabitants on this extensive island, which contains more than 600 square miles. "We ought (says he) to figure to ourselves this country as one extensive forest; they have only begun to clear and plant a few insulated spots, which are lost in it like small islands in the Pacific Ocean." Perhaps, if we could ever penetrate through the darkness which involves the history of this nation, we might find that they have arrived in the South-Sea much later than the natives of the Friendly and Society Islands: so much at least is certain, that the latter appear to be a race totally distinct from the former; their form, their language, and their manners, strongly mark this difference. The natives, on some parts of New-Guinea and Papua, seem to correspond, in many particulars, with what has been observed of the Mallicolle. They differ likewise very widely from the light-coloured inhabitants of the South-Sea, by keeping their bodies entirely free of punctures. Whatever these people saw, they coveted; but they never repined at a refusal. The looking-glasses which were given them were highly esteemed, and they took great pleasure in viewing themselves; so that these ugly people seemed to have more conceit than the beautiful nation at O-Tahitee and the Society Islands. Early the next morning the natives came off to the ship in their canoes, and four or five of them went on board without any arms. They soon became familiar, and, with the greatest ease, climbed up the shrouds to the mast-head; when they came down, the captain took them into his cabin, and gave them medals, ribbons, nails, and pieces of red baize. They appeared the most intelligent of any nation that had been seen in the South-Sea: they readily understood the meaning con-

veyed by signs and gestures; and in a few minutes Mallicollo. taught the gentlemen of the ship several words in their language, which appeared to be wholly distinct from that general language of which so many dialects are spoken at the Society-Islands, the Marquesas, Friendly-Isles, Easter-Island, and New-Zealand. Their language was not difficult to pronounce, but contained more consonants than any of them. Mr Forster, and some of the gentlemen from the ship, went on shore, and conversed with the natives, who with great good-will sat down on the stump of a tree to teach them their language. They were surprised at the readiness of their guests to remember, and seemed to spend some time in pondering how it was possible to preserve the sound by such means as pencils and paper. They were not only assiduous in teaching; but had curiosity enough to learn the language of the strangers, which they pronounced with such accuracy as led their instructors to admire their extensive faculties and quick apprehension. Observing their organs of speech to be so flexible, they tried the most difficult sounds in the European languages, and had recourse to the compound Russian *jetch*, all of which they pronounced at the first hearing without the least difficulty. They presently learned the English numerals, which they repeated rapidly on their fingers; so that what they wanted in personal beauty was amply compensated to them in acuteness of understanding. They express their admiration by hissing like a goose.

Their music is not remarkable either for harmony or variety, but seemed to be of a more lively turn than that at the Friendly-islands. Their behaviour to their visitors was, in general, harmless, but cautious: they gave them no invitation to stay among them; for they seemed not to relish the proximity of such powerful people, being probably accustomed to acts of violence and outrage from their neighbours. "In some of their countenances (says Mr Forster), we thought we could trace a mischievous, ill-natured disposition; but we might mistake jealousy for hatred."

Very few women were seen, but those few were no less ugly than the men: they were of small stature, and their heads, faces, and shoulders, were painted red. Those who were grown up, and probably married, had short pieces of a kind of cloth, or rather matting, round their waists, reaching nearly to their knees; the rest had only a string round the middle, with a wisp of straw; and the younger ones, from infancy to the age of 10 years, went stark naked, like the boys of the same age. The women were not observed to have any finery in their ears or round their necks and arms, it being fashionable in this island for the men only to adorn themselves; and wherever this custom prevails, the other sex is commonly oppressed, despised, and in a state of servility. Here the women were seen with bundles on their backs, which contained their children; the men seemed to have no kind of regard for them. None of them came off to the ship, and they generally kept at a distance when any party landed from the boat. They perforate the cartilage of the nose between the nostrils; and thrust therein a piece of white stone about an inch and a half long, which is bent like the curvature of a bow. The houses here are, like those of the other isles, rather low, and covered with a palm-

thatch. Some were inclosed or walled round with boards, and the entrance to these was by a square hole at one end.

Their weapons are bows and arrows, and a club about two feet and a half in length, made of the cauarina wood, commonly knobbed at one end, and well polished. This weapon they hang on their right shoulder, from a thick rope made of a kind of grass. It appeared to be preferred for close engagements, after having emptied the quiver. On the left wrist they wear a circular wooden plate, neatly covered, and joined with straw, about five inches in diameter, upon which they break the violence of the recoiling bow-string, and preserve their arm unharmed. Their arrows are made of a sort of reed; and are sometimes armed with a long sharp point made of the red-wood, and sometimes with a very hard point made of bone: and these points are all covered with a substance which was supposed to be poisoned. Indeed the people themselves confirmed these suppositions, by making signs to the gentlemen of the ship not to touch the point, and giving them to understand that if they were pricked by them they would die: they are very careful of them themselves, and keep them always wrapped up in a quiver. Some of these arrows are armed with two or three points each, with small prickles on the edge to prevent the arrow from being drawn out of the wound. Repeated and effectual trials of the virulence of this poison were made upon dogs, but they gave no signs of being hurt by it.

Their food seems to be principally vegetables, since they apply themselves to husbandry. As hogs and fowls are bred here, the natives, doubtless, feast sometimes on pork and poultry; and as they have canoes, it may be supposed that they draw a part of their subsistence from the ocean. The greatest number of canoes that were seen along-side the ship at one time did not exceed 10, or, according to Mr Forster, 14, and no more than four or five people in each: they were small, of indifferent workmanship, and without ornament; but provided with an outrigger.

After some slight indications of a hostile intention on the part of the natives, which they had shown in their canoes whilst about the ship, captain Cook, with a party of marines in two boats, landed in the face of 400 or 500 Indians who were assembled on the shore. Tho' they were all armed with bows and arrows, clubs and spears, they made not the least opposition; on the contrary, seeing the captain advance alone, unarmed, with only a green branch in his hand, one of them, who seemed to be a chief, giving his bow and arrows to another, met him in the water, bearing also a green branch. When they met, the branches were exchanged; and the chief led the captain by the hand up to the crowd, to whom he immediately distributed presents: in the mean time the marines were landed, and drawn up upon the beach. The captain then made signs that he wanted wood, and they by signs gave him permission to cut down the trees. A small pig was presently brought, and presented to the captain, who in return gave the bearer a piece of cloth. It was expected from this instance, that an exchange of provisions for various articles of merchandise would take place: but these expectations proved fallacious; no

more pigs were procured, and only about half a dozen cocoa-nuts, and a small quantity of fresh water. As these islanders were possessed of hogs as well as fowls, their backwardness to part with either might be owing to the little estimation in which they held such articles as were tendered in barter; for they set no value on any nails, or any other kind of iron-tools, and held all the gew-gaws of finery equally cheap. They would now and then exchange an arrow for a piece of cloth, but very seldom would part with a bow. After finding on board what wood had been cut, the party all embarked, and the natives dispersed. When the ship was about to leave this island, captain Cook gives the following relation: "When the natives saw us under sail, they came off in canoes, making exchanges with more confidence than before, and giving such extraordinary proofs of their honesty as surprised us. As the ship at first had fresh way thro' the water, several of the canoes dropped after after they had received goods, and before they had time to deliver theirs in return: instead of taking advantage of this, as our friends at the Society-islands would have done, they used their utmost efforts to get up with us, and deliver what they had already been paid for. One man in particular followed us a considerable time, and did not reach us till it was calm, and the thing was forgotten. As soon as he came along-side, he held up the article, which several on board were ready to buy: but he refused to part with it till he saw the person to whom he had before sold it; and to him he gave it. The person not knowing the man again, offered him something in return, which he refused; and showing him what had been given before, at length made him sensible of the nice sense of honour which had actuated this Indian."

MALLOW, a manor, and also a borough town in the county of Cork, and province of Munster in Ireland, above 118 miles from Dublin. It was incorporated by charter in 1688, and sends two members to parliament. It is pleasantly situated on the north bank of the Blackwater, over which there is an excellent stone-bridge. Here is also a good church, a market house, and barracks for a troop of horse. Not far distant is a fine spring of a moderately tepid water, which bursts out of the bottom of a fine limestone rock, and approaches the nearest in all its qualities to the hot-well waters of Britol of any that has been yet discovered in this kingdom, which brings a resort of good company there frequently in the summer months, and has caused it to be called the *Irish Bath*. Mallow is a poist town, and has five fairs.

MALLOW, in botany. See MALVA.

Marj-b-MALLOW. See ALTHEA.

Indian-MALLOW. See SIDA.

MALMSBURY, a town of Wiltshire, in England, 95 miles from London. It stands on a hill, with six bridges over the river Avon at the bottom; with which, and a brook that runs into it, it is in a manner encompassed. It formerly had walls and a castle, which were pulled down to enlarge the abbey, which was the biggest in Wiltshire, and its abbots sat in parliament. The Saxon King Athelstan granted the town large immunities, and was buried under the high altar of the church, and his monument still remains in the nave

Malmesbury
Malo.

of it. The memory of Aldhelm, its first abbot, who was the king's great favourite, and whom he got to be canonized after his death, is still kept up by a meadow near this town, called Aldhelm's Mead. By charter of King William III. the corporation consists of an alderman, who is chosen yearly, 12 capital burgesses, and 4 assistants, land-holders and commoners. Here is an alms-house for 4 men and 4 women, and near the bridge an hospital for lepers, where it is supposed there was formerly a nunnery. This town drives a considerable trade in the woollen manufactory; has a market on Saturday, and three fairs. It has sent members to parliament ever since the 26th of Edward I.

William of MALMSBURY. See WILLIAM.

MALO (St) a sea-port town of France, in the province of Brittany, situated in the latitude of 48 degrees 38 minutes north, and 1 degree 57 minutes to the west. The town stands upon a rock called the island of St Aaron, surrounded by the sea at high water, which is now joined to the continent, by means of a fort of caufey or dike, near a mile long, called the Sillon, which has been often damaged by storms, and was almost quite ruined in the year 1730. At the end of this caufey next the town is a castle, flanked with large towers, a good ditch, and a large bastion. The city nearly covers the whole surface of the island, and is of an oblong form, surrounded with a strong rampart, on which there is a number of cannon.—There is always in it a good garrison. The cathedral-church is dedicated to St Vincent, and stands in the square of the same name, as do also the town-house and the episcopal palace. There are some other squares in the place, but less remarkable; and as to the streets, except two or three, they are all very narrow. There being no spring of fresh water in St Malo, the inhabitants are at great pains to convey the rain which falls on the roofs of their houses into cisterns; and of this they have enough for all family-uses. There is only one parish-church in the town, though it contains between 9000 and 10,000 inhabitants; but there are several convents of monks and nuns, and a general hospital. The two entrances into the harbour are defended by several forts, such as that of the Conchal; of the great and the little bay; the forts of Ile-Rebours, Sezembe, Roteneuf; the castle of Latte, and Fort-Royal. There are several little isles near the harbour, the most considerable whereof is that of St Sezembe, which is near a quarter of a league in circumference, and serve as so many outworks to the fortifications of the city, and are useful as bulwarks, by breaking the violence of the waves, which otherwise would beat with great force against the walls of the city. At the end of the caufey next the continent stands the suburb of St Servant, large and well built. Here the merchants have their houses and store-houses. Here is the dock-yard; and a secure harbour is formed by the river Rance, where ships of great burden can ride at anchor very near the houses. The harbour is one of the best in the kingdom, and most frequented by merchant-ships; but it is of very difficult and dangerous access on account of the rocks which lie round it. The town of St Malo is exceedingly well situated for trade; and accordingly, in this respect, it has succeeded beyond most towns in France. It main-

Malo,
Malouin.

tains a trade with England, Holland, and Spain.—The commerce of Spain is of all the most considerable, and most profitable to the inhabitants of St Malo, the ships of the Malouins being frequently employed as register ships by the Spaniards, to carry out the rich cargoes to Peru and Mexico, and bring home treasure and plate from America. The inhabitants of St Malo carry on also a considerable trade in dry and salted cod to Newfoundland. They tend to this fishery a good many vessels from 100 to 300 tons burden, with salt for the fish, and provisions for subsisting the crews. They carry their fish to Italy, Spain, and some to Bourdeaux and Bayonne, and bring home the returns in fruits, soap, oil, &c. which are disposed of to great advantage at Nantz. St Malo is the capital of the bishopric of that name, which is of considerable extent; and the soil about it produces most kinds of grain and fruits in great abundance. The most remarkable towns in the district and diocese of St Malo, are St Servand, Cancale, Chateaufneuf, Dinan, Tintinac, Combours, Montfort, Bréal, Guer, Ploermel, Josselin, &c.

MALO, MACLOU, or *Malout*, (Saint), the son of a gentleman in Great Britain, and cousin to St Magloire, was educated in a monastery in Ireland, and afterwards chosen bishop of Gui-Castel, a dignity which his humility prevented him from accepting. The people wishing to compel him, he went into Brittany, and put himself under the direction of a holy anchorite called Aaron, in the neighbourhood of Aleth. Some time after, about the year 541, he was chosen bishop of that city, and there cultivated piety and religion with great success. He afterwards retired to a solitude near Xaintes, where he died November 15. 565. From him the city of St Malo derives its name; his body having been carried thither, after the reduction of Aleth to a small village called *Guidalet* or *Guicbalet*, and the transference of the episcopal see to St Malo.

MALOUIN (Paul-Jaques), born at Caen in 1701, was professor of medicine in the royal college of Paris, physician in ordinary to the queen, and a member of the Royal Society of London, and of the Academy of Sciences of Paris. These stations were a proper reward for his very extensive information in medicine and chemistry; and his amiable and steady character procured him many friends and protectors. He was very unlike some modern physicians, who put little trust in medicine; and was greatly displeased to hear any ill spoken of his profession. He observed one day to a young man who took this liberty, that all great men had respected medicine: *Ah!* said the young fellow, *you must at least except from the list one Moliere.* But then, instantly replied the doctor; *you see he is dead.* He is said to have believed the certainty of his art as firmly as a mathematician does that of geometry. Having prescribed a great many medicines for a celebrated man of letters, who followed his directions exactly, and was cured, Malouin eagerly embraced him, saying, *You deserve to be sick.* As he valued the rules of medicine still more on his own account than on that of others, he observed, especially in the latter part of his life, a very austere regimen. He strictly practised the preservative part of medicine, which is much more certain in its effects than the restorative. To this regimen

Malouin
 Malpighi

men Malouin was indebted, for what many philosophers have defined in vain, a healthy old age and early death. He was a stranger to the infirmities of age; and died at Paris of an apoplexy, the 3d of January 1778, in the 77th year of his age. By his will he left a legacy to the faculty of medicine, upon condition of their holding a public meeting every year for the purpose of giving the public an account of his labours and discoveries. Malouin was economical, but at the same time very disinterested. After two years of very lucrative practice, he left Paris and went to Versailles, where he saw very few patients, observing that he had retired to the court. His principal works are, 1. *Traité de Chimie*, 1734, 12mo. 2. *Chimie medicinale*, 2 vols 12mo, 1755; a book full of curious observations, and written in a chaste and well adapted style. He had the character of a laborious chemist; and he was a well informed and even a distinguished one for the age in which he lived: but his knowledge of chemistry, it must be confessed, was very imperfect, compared with the state of the science in the present age, in which it has assumed a new face, that probably will not be the last. 3. Some of the Arts in the Collection published by the academy of sciences on the arts and professions. A circumstance which happened at a meeting of the academy does as much honour to his heart, as any of his works do to his understanding. A new treatise on the art of baking, wherein some of Malouin's ideas were combated, was read by M. Parmentier before his fellows, among whom was the old doctor. The young academicien, who knew how easily self-love is hurt, was afraid to meet his looks: but no sooner was the reading finished, than Malouin went up to him, and embracing him, "Receive my respects (said he), you have seen farther into the subject than I did." 4. He was likewise the author of the chemical articles in the *Encyclopédie*.

Of the same family was *Charles Maroviv*, who graduated as a doctor of medicine in the university of Caen, and died in 1718 in the flower of his age. He published a *Treatise on Solids and Fluids*, Paris 1718, 12mo.

MALPAS, a town of Cheshire, 166 miles from London. It stands on a high hill, not far from the river Dee, on the borders of Shropshire; has a grammar-school, and an hospital, and had formerly a castle. It is called in Latin *Mala Platea*, i. e. "Ill Street," and was, for the same reason, by the Normans, called *Mal Pas*; but its three streets, of which it chiefly consists, are now well paved; and here is a benefice rich enough to support two rectors, who officiate alternately in its stately church. It has a good market on Mondays, and three fairs in the year.

MALPIGHI (Marcellus), an eminent Italian physician and anatomist in the 17th century. He studied under Maffari and Mariano. The duke of Tuscany invited him to Pisa, to be professor of physic there. In this city he contracted an intimate acquaintance with Borelli, to whom he ascribed all the discoveries he had made. He went back to Bologna, the air of Pisa not agreeing with him. Cardinal Antonio Pignatelli, who had known him while he was legate at Bologna, being chosen pope in 1691, under the name of *Innocent XII.* immediately sent for him to Rome, and ap-

pointed him his physician. But this did not hinder him from pursuing his studies, and perfecting his works, which have immortalized his memory. He died in 1694; and his works, with his life written by himself prefixed, were first collected and printed at London, in folio, in 1667.

MALPIGHIA, BARBADOES CHERRY, a genus of the trigynia order, belonging to the decandria class of plants; and in the natural method ranking under the 23d order, *Tribilata*. The calyx is pentaphyllous, with melliferous pores on the outside at the base. There are five petals, roundish, and unguiculated: the berry unilocular, and trispermous. There are eight or ten species, all of them shrubby evergreens of the warm parts of America, rising with branchy stems from 8 or 10 to 15 or 20 feet high, ornamented with oval and lanceolate entire leaves, and large pentapetalous flowers, succeeded by red, cherry-shaped, eatable berries, of an acid and palatable flavour; and which, in the West Indies, where they grow naturally, are used instead of cherries. Three of the species are reared in our gardens, and make a fine variety in the stove. They retain their leaves all the year round; and begin to flower about the end of autumn, continuing in constant succession till the spring; after which they frequently produce and ripen their fruit, which commonly equals the size of a small cherry. The flowers are of a pale-red or purple colour. These plants are propagated by seed, which must be sown in spring, in pots of rich earth: then plunge them in a hot-bed; and when the plants are three or four inches high, prick them in separate small pots, give water, and plunge them in the bark-bed of the stove; where after they have remained a year or two, they may be placed in any part of it. They may even be placed in the open air during a month or two of the hottest weather in summer; but must be carefully supplied with water during the whole year.

MALPLAQUET, a village of the Netherlands, in Hainault, famous for a most bloody battle fought here on the 11th of September 1709, between the French under old marshal Villars, and the allies commanded by prince Eugene and the duke of Marlborough. The French army amounted to 120,000 men; and were posted behind the woods of La Marte and Taniers, in the neighbourhood of Malplaquet. They had fortified their situation in such a manner with lines, hedges, and trees laid across, that they seemed to be quite inaccessible. In this situation they expected certain victory; and even the common soldiers were so eager to engage, that they flung away the bread which had been just given them, though they had taken no sustenance for a whole day before. The allied army began the attack early in the morning, being favoured by a thick fog. The chief fury of their impression was made upon the left of the enemy; and with such success, that, notwithstanding their lines and barricades, the French were in less than an hour driven from their entrenchments. But on the enemy's right the combat was sustained with much greater obstinacy. The Dutch, who carried on the attack, drove them from their first line; but were repulsed from the second with great slaughter. The prince of Orange, who headed that attack, persisted in his efforts with incredible perseverance

Malt. feverance and intrepidity, though two horſes had been killed under him, and the greater part of his officers ſlain and diſabled. At laſt, however, the French were obliged to yield up the field of battle; but not till after having ſold a dear-bought victory. Villars being dangerously wounded, they made an excellent retreat under the conduct of Boufflers, and took poſt near Gueſnoy and Valenciennes. The conquerors took poſſeſſion of the field of battle, on which above 20,000 of their beſt troops lay dead. The loſs of the French, it is ſaid, did not exceed 8000; and marſhal Villars confidently aſſerted, that, if he had not been diſabled, he would have gained an undoubted victory.

MALT denotes barley cured, or prepared to fit it for making a potable liquor, under a denomination of *beer* or *ale*. See BREWING.

Malt-Liquors have different names as well as different virtue, properties, and uſes, both from the different manners of preparing the malt; whence they are diſtinguiſhed into *pale* and *brown*; and from the different manners of preparing or brewing the liquors themſelves; whence they are divided into *beer* and *ale*, *ſtrong* and *ſmall*, *new* and *old*.

Malt drinks are either pale or brown, as the malt is more or leſs dried on the kiln; that which is the ſlenderſt dried tinging the liquor leaſt in brewing, and therefore being called *pale*; whereas that higher dried, and as it were roaſted, makes it of a higher colour. A mixture of both theſe makes an amber colour; whence ſeveral of theſe liquors take their name.

Now, it is certain, the pale malt has moſt of the natural grain in it, and is therefore the moſt nourishing; but, for the ſame reaſon, it requires a ſtronger conſtitution to digeſt it. Thoſe who drink much of it, are uſually fat and ſleek in their bloom, but are often cut off by ſudden fevers; or, if they avoid this, they fall early into a diſtempered old age.

The brown malt makes a drink much leſs viſcid, and ſitter to paſs the ſeveral ſtrainers of the body; but, if very ſtrong, it may lead on to the ſame inconveniences with the pale: though a ſingle debauch wears off much more eaſily in the brown.

Dr Quincy obſerves, that the beſt pale malt liquors are thoſe brewed with hard waters, as thoſe of ſprings and wells, becauſe the mineral particles, wherewith theſe waters are impregnated, help to prevent the coheſions of thoſe drawn from the grain, and enable them to paſs the proper ſecretions the better; as the viſcid particles of the grain do likewiſe defend theſe from doing the miſchief they might otherwiſe occaſion. But ſofter waters ſeem beſt ſuited to draw out the ſubſtance of high-dried malts, which retain many fiery particles in their texture, and are therefore beſt ſuited in a ſmooth vehicle.

For the differences in the preparation of malt liquors, they chiefly conſiſt in the uſe of hops, as in *beer*; or in the more ſparing uſe of them, as in *ale*.

The difference made by hops is beſt diſcovered from the nature and quality of the hops themſelves: theſe are known to be a ſubtle grateful bitter; in their compoſition, therefore, with this liquor, they add ſomewhat of an alkaline nature, *i. e.* particles that are ſublime, active, and rigid. By which means, the *ropy* viſcid parts of the malt are more divided and

ſubtilized: and are therefore not only rendered more eaſy of digeſtion and ſecretion in the body, but alſo, while in the liquor, they prevent it from running into ſuch coheſions as would make it ropy, rapid, and four.

For want of this, in unhopped drinks, that clammy ſweetneſs, which they retain after working, ſoon turns them acid and unſuited for uſe; which happens ſooner or latter in proportion to the ſtrength they receive from the malt, and the comminution that has undergone by fermentation.

It is a common opinion, that ale is more diuretic than beer; that is, liquor leſs hopped more than that with a greater quantity of hops in it: which may hold in ſome conſtitutions; becauſe ale being more ſmooth, ſoftening, and relaxing, where urine is to be promoted by enlarging the paſſage, as in thin, dry conſtitutions, this is the moſt likely to effect it. But, where the promoting of urine is to be done by attenuating and breaking the juices, and rendering them more fluid, it is certainly beſt answered by thoſe drinks which are well hopped.

As to the diſpute, whether or no hops tend to breed the ſtone; it is too long to enter upon here. Quincy is of opinion, there is but little reaſon for the affirmative ſide of the queſtion; and in the general, makes no ſcruple to ſay, that, for one conſtitution damaged by beer, there are numbers ſpoiled by ale. This laſt manifeſtly ſouls the glands, ſtuſſes the veſſels with ſlime and viſcidities, makes the body unwieldy and corpulent, and paves the way for cachexies, jaundice, aſthma, and at laſt incurable dropſies. The urinary paſſages, alſo, which it is ſuppoſed to clear, will, in time, be filled by it with ſlough and matter of aſ ill conſequence as gravel.

The different ſtrengths of malt liquors alſo make their effects different. The ſtronger they are, the more viſcid parts they carry into the blood; and though the ſpirituous parts make theſe imperceptible at firſt; yet when thoſe are evaporated, which will be in a few hours, the other will be ſenſibly felt by pains in the head, nauſeouſneſs at the ſtomach, and laſſitude or liſtleſſneſs to motion. This thoſe are the moſt ſenſible of who have experienced, the extremes of drinking theſe liquors and wines; for a debauch of wine they find much ſooner worn off, and they are much more lively and brisk afterwards, than after fuddling malt liquors, whoſe viſcid remains will be long before they be ſhaken off.

Malt liquors therefore are, in general, the more wholeſome for being ſmall; *i. e.* of ſuch a ſtrength as is liable to carry a ſmall degree of warmth into the ſtomach, but not ſo great as to prevent their being proper diluters of the neceſſary food. Indeed, in robuſt people, or thoſe who labour hard, the viſcidities of the drink may be broken into convenient nourishment; but in perſons of another habit and way of living, they ſerve rather to promote obſtructions and ill humours.

The age of malt liquors is the laſt thing by which they are rendered more or leſs wholeſome. Age ſeems to do nearly the ſame thing as hops; for thoſe liquors which are longeſt kept are certainly the leaſt viſcid; age breaking the viſcid parts, and by degrees rendering them ſmaller, and ſitter for ſecretion.

But

Malt.

But this is always determined according to their strength; in proportion to which, they will sooner or later come to their full perfection as well as decay; for, when ale or beer is kept till its particles are broken and comminuted as far as they are capable, then it is that they are best; and, beyond this, they will be continually on the decay, till the finer spirits are entirely escaped, and the remainder becomes vapid and sour.

Malt-Distillery. This is an extensive article of trade, and by which very large fortunes are made. The art is to convert fermented malt liquors into a clear inflammable spirit, which may be either fold for use in the common state of a proof strength, that is, the same strength with French brandy; or is rectified into that purer spirit usually fold under the name of *spirit of wine*; or made into compound cordial waters, by being distilled again from herbs and other ingredients. See BREWING and WASH.

To brew with malt in the most advantageous manner, it is necessary, 1. That the subject be well prepared; 2. That the water be suitable and duly applied; and, 3. That some certain additions be used, or alterations made, according to the season of the year, and the intention of the operator: and by a proper regulation in these respects, all the fermentable parts of the subject will thus be brought into the tincture, and become fit for fermentation.

The due preparation of the subject consists in its being justly malted and well ground. When the grain is not sufficiently malted, it is apt to prove hard, so that the water can have but very little power to dissolve its substance; and if it be too much malted, a part of the fermentable matter is lost in that operation. The harder and more stony the malt is, the finer it ought to be ground; and in all cases, when intended for distillation, it is advisable to reduce it to a kind of finer or coarser meal. When the malt is thus ground, it is found by experience that great part of the time, trouble, and expence of the brewing is saved by it, and yet as large a quantity of spirit will be produced; for thus the whole substance of the malt may remain mixed among the tincture, and be fermented and distilled among it. This is a particular that very well deserves the attention of the malt distiller as that trade is at present carried on; for the dispatch of the business, and the quantity of spirit procured, is more attended to than the purity or perfection of it.

The secret of this matter depends upon the thoroughly mixing or briskly agitating and throwing the meal about, first in cold and then in hot water; and repeating this agitation after the fermentation is over, when the thick turbid wash being immediately committed to the still already hot and dewy with working, there is no danger of burning, unless by accident, even with it the farther trouble of stirring, which in this case is found needless, though the quantity be ever so large, provided that requisite care and cleanliness be used; and thus the business of brewing and fermenting may very commodiously be performed together, and reduced to one single operation. Whatever water is made choice of, it must stand in a hot state upon the prepared malt, especially if a clear tincture be desired; but a known and very great inconve-

nience attends its being applied too hot, or too near to a state of boiling, or even scalding with regard to the hand. To save time in this case, and to prevent the malt running into lumps and clods, the best way is to put a certain measured quantity of cold water to the malt first; the malt is then to be stirred very well with this, so as to form a sort of thin uniform paste or pudding; after which the remaining quantity of water required may be added in a state of boiling, without the least danger of making what, in the distillers language, is called a *pudden*.

In this manner the due and necessary degree of heat in the water, for the extracting all the virtues of the malt, may be hit upon very expeditiously, and with a great deal of exactness, as the heat of boiling water is a fixed standard which may be let down to any degree by a proportionate mixture of cold water, due allowances being made for the season of the year, and for the temperature of the air.

This little obvious improvement, added to the method just above hinted for the reducing brewing and fermentation to one operation, will render it practicable to very considerable advantage, and the spirit improved in quality as well as quantity.

A much more profitable method than that usually practised for the fermenting malt for distillation, in order to get its spirit, is the following: take ten pounds of malt reduced to a fine meal, and three pounds of common wheat-meal: add to these two gallons of cold water, and stir them well together; then add five gallons of water, boiling hot, and stir altogether again. Let the whole stand two hours, and then stir it again; and when grown cold, add to it two ounces of solid yeast, and let it by loosely covered in a warmish place to ferment.

This is the Dutch method of preparing what they call the *wash for malt spirit*, whereby they save much trouble and procure a large quantity of spirit: thus commodiously reducing the two businesses of brewing and fermenting to one single operation. In England the method is to draw and wash for spirit as they ordinarily do for beer, only instead of boiling the wort, they pump it into large coolers, and afterwards run it into their fermenting backs, to be there fermented with yeast. Thus they bestow twice as much labour as is necessary, and lose a large quantity of their spirit by leaving the gross bottoms out of the still for fear of burning.

All simple spirits may be considered in the three different states of low wines, proof spirit, and alcohol, the intermediate degrees of strength being of less general use; and they are to be judged of only according as they approach to or recede from these. Low wines at a medium contain a sixth part of pure inflammable spirit, five times as much water as spirit necessarily arising in the operation with a boiling heat. Proof goods contain about one half of the same totally inflammable spirit; and alcohol entirely consists of it.

Malt low-wines, prepared in the common way, are exceeding nauseous; they have, however, a natural vinosity or pungent agreeable acidity, which would render the spirit agreeable to the palate were it not for the large quantity of the gross oil of the malt that abounds in it. When this oil is detained in some measure

Malt.

measure from mixing itself among the low wines, by the stretching a coarse flannel over the neck of the still or at the orifice of the worm, the spirit becomes much purer in all respects; it is less fulsome to the taste, less offensive to the smell, and less milky to the eye. When these low wines, in the rectification into proof-spirits, are distilled gently, they leave a considerable quantity of this gross fetid oil behind them in the still along with the phlegm; but if the fire be made fierce, this oil is again raised and brought over with the spirit; and being now broken somewhat more fine, it impregnates it in a more nauseous manner than at first. This is the common fault both of the malt distiller and of the rectifier; the latter, instead of separating the spirit from this nasty oil, which is the principal intent of his process, attends only to the leaving the phlegm in such quantity behind, that the spirit may be of a due strength as proof or marketable goods, and brings over the oil in a worse state than before. To this inattention to the proper business of the process, it is owing, that the spirit, after its several rectifications, as they are mislabeled, is often found more stinking than when delivered out of the hands of the malt distiller. All this may be prevented by the taking more time in the subsequent distillations, and keeping the fire low and regular; the sudden stirring of the fire, and the hasty way of throwing on the fresh fuel, being the general occasion of throwing up the oil by spurts, where the fire in general, during the process, has not been so large as to do that mischief.

The use of a *balneum marie*, instead of the common still, would effectually prevent all this mischief, and give a purer spirit in one rectification than can otherwise be procured in ten, or indeed according to the common methods at all.

Malt low wine, when brought to the standard of proof spirit, loses its milky colour, and is perfectly clear and bright, no more oil being contained in it than is perfectly dissolved by the alcohol, and rendered miscible with that proportion of phlegm, which is about one half the liquor: its taste also is cleaner, tho' not more pleasant; there being less of the thick oil to hang on the tongue than its own form; which is not the case in the low wines, where the oil being undissolved, adheres to the mouth in its own form, and does not pass lightly over it.

When proof-spirit of malt is distilled over again, in order to be rectified into alcohol, or, as we usually call it, spirits of wine, if the fire be raised at the time when the fumes begin to fall off, a very considerable quantity of oil will be raised by it, and will run in the visible form of oil from the nose of the worm. This is not peculiar to malt spirit; but the French brandy shows the same phenomenon, and that in so great a degree, that half an ounce of this oil may be obtained from a single piece of brandy.

Malt spirit, more than any other kind, requires to be brought into the form of alcohol, before it can be used internally, especially as it is now commonly made up in the proof state, with as much of this nauseous and viscous oil as will give it a good crown of bubbles. For this reason it ought to be reduced to an alcohol, or totally inflammable spirit, before it is admitted into any of the medicinal compositions. If it be used with-

out this previous caution, the odious taste of the malt oil will be distinguished among all the other flavours of the ingredients.

Malt spirit, when it has once been reduced to the true form of an alcohol, is afterwards more fit for all the curious internal uses than even French brandy; it being after this purification a more uniform, hungry, tasteless, and impregnable spirit, than any other spirits which we esteem so much finer.

A pure spirit being thus procured, should be kept carefully in vessels of glass or stone, well stopp'd, to prevent the evaporation of any of its volatile part. If preserved in casks, it is apt to impregnate itself very strongly with the wood. The quantity of pure alcohol obtainable from a certain quantity of malt, differs according to the goodness of the subject, the manner of the operation, the season of the year, and the skillfulness of the workmen; according to which variations, a quarter of malt will afford from eight or nine to thirteen or fourteen gallons of alcohol. This should encourage the malt distiller to be careful and diligent in his business, as so very large a part of his profit depends wholly on the well conducting his processes.

After every operation in this business, there remains a quantity of fumes, which in their own coarse state ought never to be admitted into the pure spirit; these are to be saved together, and large quantities of them at once wrought into alcohol. It is easy to reduce these to such a state that they will serve for lamp-spirits. Their disagreeable flavour being corrected by the adding of aromatics during the distillations, the reducing them into a perfect and pure alcohol is practicable, but not without such difficulties as render it scarce worth the trader's while. One way of doing it is by distilling them from water into water, and that with a very slow fire. By this means a pure alcohol may be made out of the foulest fumes.

The malt distiller always gives his spirit a single rectification *per se*, in order to purify it a little, and make it up proof; but in this state it is not to be reckoned fit for internal uses, but serves to be distilled into geneva and other ordinary compound strong waters for the vulgar.

The Dutch, who carry on a great trade with malt spirit, never give it any further rectification than this; and it is on this account, that the malt spirit of England is in general so much more in esteem. The Dutch method is only to distil the wash into low wines, and then to full proof spirit; they then directly make it into geneva, or else send it as it is to Germany, Guiney, and the East-Indies, for the Dutch have little notion of their rectification. Their spirit is by this means rendered very foul and coarse, and is rendered yet more nauseous by the immoderate use they make of rye-malt. Malt spirit, in its unrectified state, is usually found to have the common bubble proof, as the malt distiller knows that it will not be marketable without it.

The whole matter requisite to this is, that it have a considerable portion of the gross oil of the malt well broke and mixed along with it; this gives the rectifier a great deal of trouble if he will have the spirit fine; but in the general run of the business, the rectifier does not take out this oil, but breaks it finer, and mixes it faster in by alkaline salts, and disguises its

Malt.

taste by the addition of certain flavouring ingredients. The spirit loses in these processes the vinosity it had when it came out of the hands of the malt distiller, and is in all respects worse, except in the disguise of a mixed flavour.

The alkaline salts used by the rectifier destroying the natural vinosity of the spirit, it is necessary to add an extraneous acid in order to give it a new one. The acid they generally use is the spiritus nitri dulcis; and the common way of using it is the mixing it to the taste with the rectified spirit: this gives our malt spirit, when well rectified, a flavour somewhat like that of French brandy, but this soon flies off; and the better method is to add a proper quantity of Glauber's strong spirit of nitre to the spirit in the still. The liquor in this case comes over impregnated with it, and the acid being more intimately mixed, the flavour is retained.

MALT-BRUIER, or Bruising-mill. It has been found by repeated experiments, that bruising malt is a more advantageous method than the old one of grinding and flouring. By bruising, there is not only less waste, but the malt is also better fitted for giving out all its virtues. It has lately, therefore, become a practice to squeeze malt between rollers, by means of a proper apparatus, of which various constructions have been invented. As the best contrivance of this sort is said to be the bruising-mill of Mr Winlaw, we have given a figure of it on Plate CCLXXXII. where AAAA is the frame; B, the large cylinder or roller; C, the small one; D, the hopper; E, the shoe; F, the frame that supports the hopper; G, a fly-wheel; H, the windlass. To use this engine, it is directed to screw the large roller up to the small one, and not to feed two fast from the shoe, which is regulated by pins that have strings fixed to them. It is evident, that when two smooth surfaces are opposed to each other at a distance which can be regulated at pleasure, neither grain nor any other similar substance can pass between them without being bruised. This being the principle on which the bruising-mill acts, the mealy substance, which is the essential part of malt, is entirely removed from the skin or hulk which contains it, and all the virtues of the malt are with ease extracted by the water in a manner superior to what is effected when the grain is only cut by grinding. The operation is at the same time so expeditiously performed, that two men can with ease bruise a bushel of malt in a minute.—By the same engine may also be bruised oats and beans for horses. A great part of the corn given these animals, it is well known, is swallowed whole, and often passes through them in the same state; in which case, they cannot receive any nourishment from the grains that are unbroken: but when bruised in this engine, it eases mastication; and every grain being prepared for nutrition, a much less quantity will of course be found to be sufficient. For bruising beans, the two regulating screws must be unfixed a little; and the fly-wheel requires to be then set in motion with the hand, on account that the rollers are then a little space apart, and will not turn each other before the beans come between them.

MALT-TAX, is the sum of 750,000*l.* raised every year by parliament since 1697, by a duty of 6*d.* on the bushel of malt, and a proportionable sum on certain liquors, such as cyder and perry, which might

otherwise prevent the consumption of malt. This is under the management of the commissioners of the excise; and is indeed itself no other than the annual excise. In 1760, an additional perpetual excise of 3*d.* per bushel was laid upon malt; and in 1763, a proportional excise was laid upon cyder and perry, but new-modelled in 1766. See EXCISE.

MALTA, a celebrated island of the Mediterranean, situated between the 15th and 16th degrees of east longitude, and between the 35th and 36th degrees of north latitude. It is about 19 or 20 leagues in length, nine or ten in breadth, and 60 in circumference. Anciently it was called *Melia*; and is supposed by Cluverius, from its situation and other particulars, to be the Hiperia mentioned by Homer, whence the Pheaces were afterwards driven by the Phœnicians, and retired into Scheria and the island of Corfu; which is the more probable, as the ancient post places the mountain Melita in that island. He has likewise brought some probable arguments to prove, that Melita or Malta is the ancient *Oggia*; in which the famed nymph *Calypso*, daughter of the Ocean and Thetis, received the shipwrecked Ulysses, and detained him seven years.

The most ancient possessors of Malta, of whom we have any certain account, were the Carthaginians; from whom it was taken by the Romans: and yet during the whole time that it continued under the power of these polite nations, it was almost entirely barren. The soil was partly sandy and partly rocky, having scarcely any depth of earth; and withal so stony, that it was hardly capable of producing corn or any other grain except cummin, and some seeds of a similar nature. Its chief products were figs, melons, honey, cotton, and some few other fruits and commodities which the inhabitants exchanged for corn; and in this barren state it seems to have continued till it came into the possession of the Maltese knights. It laboured also under great scarcity of water and fuel: upon all which accounts it was till that time but thinly inhabited, there being only about 30 or 40 boroughs or other villages scattered about, and no city except the capital, called also *Malta*, and the town and fort of St Angelo, which defended the harbour: so that the whole number of its inhabitants did not exceed 12,000, including women and children; the greatest part of whom were very indigent.

According to an ancient tradition, Malta was first possessed by an African prince named *Battur*, an enemy to queen Dido; from whom it was taken by the Carthaginians, as may be justly inferred from several Punic inscriptions to be seen on stone-pillars and other monuments yet standing. From the Carthaginians it passed to the Romans, who made themselves masters of it at the same time that they subdued the island of Sicily. These were driven out by the Arabs in the year 828; who were driven out of it in their turn by Roger the Norman, earl of Sicily, who took possession of it in 1190: from which time it continued under the dominion of the Sicilian princes till the time of Char. V. when it fell under his power, along with Naples and Sicily. To cover the island of Sicily from the Turks Charles gave the island to the knights of Rhodes, since then to the knights of Malta.

The origin and history of these knights is given under

Malt.

1
Ancient
history of
the island.

2
Malta gi-
Charles gave the island to the knights of Rhodes, since then to the knights of Malta.

Malta.

der the article *Knights of MALTA and RHODES*. Here it is sufficient to observe, that in 1530, the knights of Rhodes having been expelled from that island by Soliman the Turkish sultan, and destitute of an habitation, accepted, tho' not without some reluctance on account of its barrenness, the offer made them by Charles V. of the island of Malta. The grand master having caused his two large carracks, the galleys of the order, and a good number of other transport-ships laden with great quantities of arms, ammunition, and troops, to be got ready, he and his knights embarked in the former, with all the effects, records, and treasure belonging to the order, and the rest in the latter. In their passage they suffered very much by a violent storm; in which one of their galleys split upon a rock, and one of the carracks was run aground by the violence of the waves, after having broke her three anchors. She stuck so fast, that they expected every moment to see her split in pieces; when providentially a contrary wind disengaged her without damage. This event was counted as a lucky omen, and on the 26th of October that year all the company were safely landed.

At the first landing of the Maltese knights, they found themselves obliged to lodge in a very poor town or borough at the foot of the hill on which stands the castle of St Angelo, and where their only habitations were fishermen huts. The grand-master, with the principal knights, took possession of the castle, where the accommodations were somewhat better: tho' these, too were very mean, and out of repair. Three days after, he took possession of the city, which was formerly called *Malta*, but since that time hath taken the name of the *Notable City*; and after that, of the whole island of Malta, and the neighbouring one of Gofa.

The first care of the knights, after having settled their authority through the two islands, was to provide some better accommodation for the present, and to choose a proper place where to fix their habitation. But as the island had no other defence than the old castle of St Angelo, and was so much exposed on all sides, that it would have required greater sums than their exhausted treasury could spare to put it in a proper state of defence; the grand-master was obliged to content himself with surrounding the borough abovementioned, wherein he had ordered new buildings to be reared for the present habitation of his knights, with a stout wall, to prevent its being surpris'd by the Turkish and Barbary corsairs. His design indeed, at this time, was not to have fixed the abode of the knights in the bare and defenceless island of Malta, but to stay in it only till he had got a sufficient force to attempt the conquest of *Modon*, a town of the *Morca*, and which was not only a populous and opulent place, but lay very convenient for making an attempt on the island of Rhodes, their ancient habitation, and to which they were naturally attached. This, however, did not hinder his taking all proper measures for securing Malta as well as Gofa, and laying out a proper plan for securing them from attacks, in case the design on *Modon* should fail.

In the mean time, as superstition was then universally prevalent, the grand-master, among other precious relics which they had brought from Rhodes, cau-

sed the arm of St Catharine to be carried in procession to the cathedral. Whilst they were on their march, one of the centinels gave them notice, that a large Turkish merchantman was wrecked on their coast. The grand-master immediately dispatched some of his knights and soldiers thither; who finding Isaac the patron of the ship, a native of *Modon*, and one *Maurithifala Nocher*, an excellent engineer, they were retained in the service of the order, and the latter was immediately employed in fortifying the island.

The knights were hardly settled in Malta, when the emperor, and other European potentates, endeavoured to engage them in a war with the inhabitants of *Barbary*, as the city of *Tripoli*, then held by Charles, was in great danger of falling into the hands of the infidels. The attempt on *Modon*, however, was first made; but it proved unsuccessful through the baseness of the Maltese forces: for they having been admitted into the city, during the night began to murder and plunder the inhabitants, without waiting for the arrival of the galleys which were coming to their assistance. The consequence was, that the inhabitants armed, and a desperate battle began; in which the Maltese, notwithstanding the utmost efforts, were obliged to retire, but not till they had loaded themselves with plunder, and carried away 800 women captive.

The grand-master, looking upon this disappointment as a sign that Providence had ordained Malta to be the residence of the knights, did not renew his attempts upon *Modon*; but, in 1532, joined with the emperor against the Turks, and sent a great number of his galleys to join the confederate fleet under the celebrated *Andrew Doria*. In consequence of this aid, the undertaking proved successful; and in all probability the conquest of *Modon* would have been accomplished, had not the soldiery, discouraged by the bad success of the last attempt, openly refused to proceed, and obliged the emperor to proceed to *Coron*, another town belonging to the Turks. Through the valour of the Maltese knights, this place was soon obliged to capitulate; and in a second expedition in 1533, the knights again distinguished themselves in a most eminent manner. They were quickly recalled, however, by the grand-master to the defence of the island, which was now threatened with an invasion by *Barbarossa* the celebrated Turkish corsair, who scoured those seas at the head of above fourscore galleys. This invasion, however, did not take place; and in 1534 the grand-master *Villiers de L'Isle Adam* died, and was succeeded by *Perino de Ponte*, a native of the town of *Asti* in Italy.

The new grand-master, who received intelligence of his election at *St Euphemia* in Calabria, very soon after received another express, giving an account of the wars which in that time reigned in *Tunis*, and the danger that *Tripoli* as well as Malta was in from *Barbarossa*, who was by this time become master both of *Algiers* and *Tunis*; upon which he made all the haste he could to his new government. His first care was to send a strong reinforcement to Italy; after which, he dispatched an embassy to the emperor, intreating him to equip a powerful fleet against *Barbarossa*, without which it would be impossible for *Tripoli* to hold out much longer.

Malta.

3
They attempt the conquest of Modon without success.

4
Join the emperor against the Turks.

Malta,

5
Africa invaded by Charles.

6
Desperate valour of the Maltese knights.

By this embassy from De Ponte, and another to the same purpose from Muley Hassan, the deposed king of Tunis, Charles was easily prevailed on to carry his arms into Africa; in which he was assisted by a great number of the bravest knights, together with 18 brigantines of different sizes, four of the best Maltese galleys, and their vessel called the *great carrack*, of itself almost equivalent to a squadron. In this expedition the knights distinguished themselves in a most eminent manner. At the siege of Goletta, one of the knights, named *Conversa*, an excellent engineer, by means of a *baraccola*, got almost close to the great tower, which he furiously battered with large cannon, while the great carrack, which was behind all the rest of the vessels, and by reason of its height could fire over them, did prodigious execution. A breach was soon made; and hardly was it wide enough to be scaled, when the Maltese knights jumped out of the galleys into their long-boats, and thence into the sea, with their swords in their hands, and waded through the water above their girdles, it being too shallow for boats to approach the shore. The standard-bearer of the order was the first that jumped into the water, and led the rest to the attack; they claiming every where the post of honour. They marched with the greatest resolution through the most terrible firing and showers of all kinds of missile weapons; and, having gained the shore, quickly ascended the breach, on the top of which they planted their great standard. A great number lost their lives, and scarce one came off un wounded; but the emperor did them the justice to own, that the taking the place was chiefly owing to the valour of the Maltese knights.

The city of Tunis was soon taken after the fortresses of Goletta; on the surrender of which, the emperor, designing to return into Europe, took his last dinner on board the great carrack; where he was magnificently entertained, and bestowed on the surviving knights the greatest encomiums, and marks of his esteem and gratitude to the owner. These he accompanied with considerable presents and with two new grants. By the first, they were allowed to import corn and other provisions from Sicily, without paying duty; and by the second, the emperor engaged, that none of the order should enjoy any of the estates or revenues, due to Maltese knights, throughout all his dominions, unless they were lawfully authorized by the grand-master and his council; or till the originals had been examined and registered by himself, or such ministers as he should appoint for that purpose. The fleet then set sail for Malta; where, on their arrival, they received the news of the grand-master's death, who was succeeded by Didier de Tolon de St. Jalle, a native of Provence, and then grand prior of Tholouse, where he resided at the time of his election.

The present grand-master was a man of great conduct and bravery, which he had formerly shown at the siege of Rhodes; and the situation of affairs at this time required a person of experience. The Turkish corsairs, quite tired out with the dreadful havoc made among them by Botigella, grand prior of Pisa, who seldom quitted the sea, and never failed out without sinking some of them, or making considerable prizes, had agreed to enter into a strong confederacy, either to surprize the city of Tripoli where his retreat was,

or, if that failed, to lay siege to it by sea and land; in either of which attempts, they were sure of all the assistance of Barbarossa and Hayradin, then lord of Tagiora. This last had undertaken the command and conduct of the whole enterprise; but the governor being informed of the design, prepared to give him a warm reception. Hayradin came thither with his whole force in the dead of the night, and began to scale the walls in those places where he reckoned them to be most defenceless. They no sooner appeared at the foot of them, than the garriſon, which had been kept up in arms, poured down such streams of wild-fire, boiling oil, melted lead, &c. and threw such volleys of stones, while the great and small guns so annoyed those that stood farthest off, that great numbers of them were destroyed. They perished in the attack, however, with great fury and vigour, till Hayradin, who was foremost in one of the scaldes, was knocked down by a musket-shot from the top of his ladder. He fell into the ditch, and was taken up almost dead; upon which his troops instantly dispersed themselves, and abandoned the enterprise. The governor of Tripoli, however, judging that this would not be the last visit of the kind which in all probability he would receive, immediately dispatched an express to Malta, with proposals for fortifying the city, and demolishing a strong tower on that coast named *Alcaid*, which was held by a Turkish corsair. His advice being approved of, the commander Botigella, now general of the galleys, was immediately dispatched with a sufficient force; who, having landed his men at Tripoli, immediately marched, with them and a body of Arab mercenaries towards Alcaid; and without staying to open the trenches, or any other covering than his gabions, levelled his artillery against it. Hayradin being informed of this, came with his Turks to its defence; but was intercepted by a strong detachment of Maltese knights at the head of the hired Arabs, and repulsed with loss; so that all he could do was to convey about 50 or 60 Turks into the place, and to annoy the Christians with some slight skirmishes. Botigella, perceiving that his cannon did not make such quick dispatch as he wished, sent some of his galleys; under the shelter of which he quickly sprung a mine, which brought down part of the wall, and buried most of the corsairs under it; upon which the rest, seeing the Maltese knights mount the breach sword-in-hand, immediately threw down their arms. The tower was then razed to the ground; after which Botigella marched to a town called *Adabur*, whence he drove Hayradin, who had entrenched himself in it, and gave the plunder to the Arabs. In his return he attacked and took a large Turkish galley, the cargo of which was valued at 160,000 crowns, and had on board 200 persons; so that he landed in triumph, and was received with the loud acclamations of the whole order, who came to meet him on his arrival. Soon after the grand-master fell sick and died, and was succeeded by John de Homedes.

The Maltese still continued to behave with their usual valour against the Turks; but, through the negligence of Charles V. almost all the places held by the Christians on the African coast were reduced by the infidels, and the valour exerted by the Maltese served only to destroy great numbers of them. At last the emperor's affairs in Africa were totally ruined by

Malta.

7
Privileges conferred upon them by the emperor.

8
The Turks make an unsuccessful attempt on Tripoli.

Malta.

9
The emperor
rescued by the valour
of the
Maltese
knights.

his unsuccessful expedition against ALGIERS, an account of which was given under that article, n^o 12—18. Here indeed it is thought that the emperor himself could not have escaped, had not the Maltese knights repulsed the Turks, who had attacked even the imperial quarters. They pursued them even to the gates of the city, and were in hopes of entering it with them; but the governor having caused the gates to be shut before the Turks had all got in, the knights were disappointed. When the Spanish troops re embarked, the Maltese were also of great service in repulsing the enemy; and indeed behaved on both occasions with so much valour and intrepidity, that the rest of the allies could not sufficiently admire them. The misfortune, however, was, that the losses they suffered, both of men and ships, especially by some of their best commanders, more than counterbalanced the glory they had gained. The emperor, before they parted, gave them the most ample testimony of his satisfaction and gratitude, as far as words and encomiums could go; after which, the Maltese commander set sail, with the small remains of his knights, in three shattered vessels, and arrived safely at the port of Malta about the end of November 1548.

While the Maltese were employed in this unfortunate expedition, the island was so terribly annoyed by the Turkish and other corsairs, that the port was in some measure blocked up by them; whilst the coasts, both here and at Gofa, lay exposed to frequent insults and depredations, and often to the loss of their inhabitants. This obliged the Maltese admiral Simeoni to refit his galleys with all possible expedition, and again put to sea in quest of these enemies. In this enterprise he succeeded so well, that he sent home a great number of the corsair captains in chains. Being obliged to put in at the port of Tripoli, the governor informed him, that he had just received an express from the king of Tunis, acquainting him that Barbarossa was making the most pressing complaints to the Porte against the Maltese knights, whilst his lieutenant Morat Haga was making great preparations at Tachora for the siege of Tripoli, which he doubted not would be followed by that of Tunis; the king having become odious to the Turks and Moors on account of his alliance with the emperor; after whose late disaster a great number of towns in that kingdom had revolted from him, and a much greater number of his subjects had put themselves under the protection of the Algerine monarch, who was expected shortly from Constantinople at the head of a powerful fleet.

On the receipt of these unwelcome news, an embassy was sent to the emperor, in order to persuade him to cause the fortifications of Tripoli be repaired; but without success. All that could be obtained was fair words and promises; the consequence of which was, that the Maltese made most violent and almost incredible exertions against their enemies, till at last Soliman resolved to expel the knights from Malta, as he had before done from Rhodes. To this he was chiefly incited by Dragut, an old experienced corsair, who had obtained the command of his fleet after the death of Barbarossa. The siege was accordingly commenced in 1551; but, by a stratagem, the Turkish commander was induced to depart. However, he reduced the castle of Gofa and the city of Tripoli. Nothing

happened of great consequence from that time till the year 1564, when fresh complaints being made to Soliman, he proposed, in a grand council, where most of his officers attended, to extirpate the knights altogether. This design was strenuously opposed by Hali, one of Dragut's most experienced captains, who offered the most solid reasons against it; but being overruled by the rest, an expedition against Malta was resolved upon. One of the sultan's first cares was to send some spies, in the disguise of fishermen, to take a full view of the island, who found means to bring him an exact plan of it, with all its fortifications, havens, strength, the number of its inhabitants, &c. whilst he was hastening his armaments against it. By this time, as the Maltese had very little reason to doubt that the Turkish armaments were designed against their island, the viceroy of Sicily, Don Garcia, was ordered by his master to take it in his way to the castle of Goletta, in order to consult with the grand-master about the necessary means for opposing such a formidable power. The grand-master acquainted him, that, in case of an attack upon Malta, he should want both men and corn: upon which the viceroy engaged to supply him with both on his return to Sicily; in pledge of which he left one of his sons with him, who was afterwards admitted into the order. He was no sooner departed, than the grand-master summoned all the knights of the order, dispersed through several parts of Europe, to repair to him. Those that were in Italy raised a body of 2000 foot, to which the viceroy of Sicily added two companies of Spanish forces. All the galleys of the order were employed in transporting these troops, together with all manner of provisions and ammunition, into the island; and the knights that were in it, in distributing, disciplining, and exercising their new levies, as well as the Maltese militia, against the siege. Thus the grand-master saw himself strengthened by the arrival of 600 knights, all of whom brought with them retinues of stout good servants, fit to assist in the defence of the island; whilst those, who by reason of age, sickness, or other impediments, could not repair to him, sold their most valuable effects in order to assist him with their purses. The pope, on his part, contented himself with sending a supply of 10,000 crowns; and the king of Spain ordered his viceroy Don Garcia to raise an army of 20,000 men, to be ready to sail thither as soon as called for. The grand-master employed the remainder of his time in visiting all the forts, magazines, arsenals, &c. and assigning to each tongue their several posts, and making all necessary preparations, till the Ottoman fleet appeared in sight on the 18th of May 1565. It consisted of 159

Malta.

11
The siege
commenced.

12
The Turks
take Tripoli,
&c. and re-
solve to
expel the
knights
from Mal-
ta.

spread themselves over the country; setting fire to the villages,

Malta.

villages, putting the peasants to the sword, and carrying off such of the cattle as, notwithstanding the orders of the grand-master, had not been secured within the forts and towns.

While the Turks were thus employed, La Valette (the grand master) sent out De Copier, marshal of the order, with 200 horse and 600 foot, to watch their motions. De Copier, an officer of great experience, executed his commission with so much prudence and vigour, that, by falling unexpectedly on detached parties, he cut off 1500 Turks, with the loss only of 80 men.

The Turkish general held a council of war as soon as all his troops were landed, to assist him in resolving where he should begin his attack. Piali, the Turkish admiral, agreeably to what he understood to have been the sultan's instructions, was of opinion that they ought not to enter upon action till Dragut should arrive. But Mustapha having received information of the king of Spain's preparations, thought something ought to be done instantly for the safety of the fleet; which lay at present in a creek, where it was exposed to the violence of the east wind, and might be attacked with great advantage by the Spaniards. On this account he was of opinion, that they should immediately lay siege to a fort called *St Elmo*, which stood on a neck of land near Il Borgo, having the principal harbour on one side of it, and on the other another harbour large enough to contain the whole fleet in safety. This proposal was approved by a majority of the council, and Mustapha proceeded without delay to carry it into execution.

La Valette did not expect that a place which was so small, and so large enough to admit a numerous garrison, could be defended long against so great a force as was employed to reduce it; but he thought it necessary that the siege of this fort should be prolonged as much as possible, in order to give the viceroy of Sicily time to come to his relief. With this view, he resolved to throw himself into *St Elmo*, with a select body of troops; and he was preparing to set out, when the whole body of knights remonstrated with such earnest importunity against his leaving the town, that he at last consented to suffer the reinforcement, which he had prepared, to be conducted to the fort by a knight called *De Medran*, upon whose conduct and intrepidity he could rely with the most assured confidence.

Not long after *De Medran*'s arrival in the fort, the garrison made a vigorous sally, in which they drove the enemy from their entrenchments, and put a number of them to the sword. But the rest soon recovered from their surprise; and having returned to the charge, they compelled the Christians to retire. In this encounter, the vigorous efforts of the Janisaries were favoured by the wind, which blew the smoke of the guns upon the fort, and covered the besieged with a thick cloud, through which it was impossible to discern the operations of the enemy. This incident the Turks had the presence of mind to improve to very great advantage. They seized, unperceived, upon the counterescarp; made a lodgment there with beams, woolfacks, and gabions; and raised a battery upon it with incredible expedition. After the smoke was dispersed, the besieged beheld what had been done

with much astonishment; and they were the more disquieted, as the fortification which the Turks had raised upon the counterescarp overtopped a ravelin which lay near it, in which the besieged could no longer appear with safety. They resolved, however, to defend this ravelin as long as possible, whatever it should cost them.

In the mean time Dragut, and another noted Corsair named *Uluchiali*, arrived with 20 galleys; having, besides slaves and seamen, 2500 troops on board. This reinforcement, and the presence of Dragut, added fresh vigour to the operations of the siege. This gallant Corsair exposed himself, on all occasions, with the utmost intrepidity; spent whole days in the trenches; and as, besides his other extraordinary talents, he was particularly skilful in the management of artillery, he caused some new batteries to be raised in more advantageous situations than had hitherto been made choice of; and kept up a continual fire both on the ravelin above mentioned and a cavalier that covered the fort, and was one of its principal defences.

This cavalier soon became the only defence which could prevent the besiegers from coming up to the very foot of the wall. Some Turkish engineers having approached the ravelin at day-break, to observe the effects of their artillery, they perceived a gun-port so low, that one of them, when mounted on the shoulders of another, looked into it, and saw the Christian soldiers lying on the ground asleep. Of this they gave immediate information to the troops; who, advancing as quickly and silently as possible, and clapping ladders to the gun-hole, got up into the ravelin, and cut off most of the Christians to pieces.

Between this ravelin and the cavalier lay the ditch, over which the besieged had thrown a temporary bridge of planks leading up to the cavalier. The Turks, perceiving this, leaped instantly upon the bridge, and attempted to make themselves masters of the cavalier, as they already were of the ravelin. But the garrison was now alarmed; the bravelt of the knights hastened from different quarters to the post of danger; and, after an obstinate engagement, they compelled the Turks to retire into the ravelin. There, observing another way of reaching the cavalier by a path from the bottom of the ditch, they threw themselves down without dread or hesitation; and having ascended by this path to the other side, they renewed their attack with greater fury than ever. The combat lasted from sun-rise till noon, when the knights at last proved victorious. About 20 knights and 100 soldiers were killed; and near 3000 of the enemy.

As the ravelin was open on the side towards the fort, the besieged pointed some cannon against it, and made great havoc among the infidels. But Mustapha, sensible of the value of the acquisition he had made, poured in fresh soldiers without number, and the pioneers coming forward with woolfacks, planks, and gabions, put the troops at length in safety, and made a lodgment in the ravelin, of which the garrison were never afterwards able to dispossess them.

The grand-master's concern on account of this disaster was greatly augmented, by considering, that it could not have happened so soon without some negligence on the part of the garrison. He sent them, however, an immediate reinforcement; and both the

Malta.

12
Desperate
defence of
fort St El-
mo.

siege

Malta.

siege and the defence were carried on with the same vigour as before.

But the situation of the besieged was now become much more dangerous than formerly. The Turks applied with unremitting diligence to heighten the ravelin till it overtopped the wall of the fort; and after this the garrison could no longer appear upon the parapet with safety. Many were killed by the enemy's artillery, several breaches were made in the wall, and the hearts of the bravest knights began to fail within them.

They agreed therefore, though with much reluctance, to apply to the grand-master for liberty to quit the fort; and they made choice of the chevalier de Medran for their messenger. He represented that the fort was in reality no longer tenible; and that, to continue in it, though only for a few days, would infallibly occasion the destruction of the garrison.

Most of the knights in council thought that this request of the garrison ought to be immediately granted. But la Valette was of a contrary opinion.—This he represented to the chevalier de Medran; and sent him back with instructions to remind the knights of the vows which they took, at their entrance into the order, of sacrificing their lives for its defence. He likewise bad him assure them, in his name, that he would not fail to send them such reinforcements as they should stand in need of; and was determined, as soon as it should be necessary, to come himself to their assistance, with a fixed unalterable purpose to lay down his life sooner than deliver the fort into the hands of the infidels.

This answer had the desired effect on several of the knights, and particularly on those whose principles of honour and attachment to the order were confirmed by years. But the greater part of them were much dissatisfied. They thought the grand-master's treatment of them harsh and cruel; and wrote him a letter, subscribed by 53; in which, after repeating their former request, they informed him, that if he did not, on the next night, send boats to carry them to the town, they were determined to fall out into the Turkish camp, where they might fall honourably by the sword, instead of suffering such an ignominious death as they had reason to expect if the fort was taken by storm.

To this letter la Valette replied, "That they were much mistaken if they expected to satisfy their honour by throwing away their lives; since it was no less their duty to submit to his authority, than to sacrifice their lives in defence of the order: that the preservation of the whole depended on their present obedience to his commands: that no aid was to be expected from Spain if the fort were given up. And that if he should yield to their request, and bring them to the town, the town itself would then be immediately invested; and they, as well as the rest, soon afterwards reduced to a situation more desperate than that from which they were so solicitous to escape, by deserting an important post which they had undertaken to defend." Besides this letter, he sent three commissioners to examine the state of the fortifications; intending by this measure either to gain time or to prevent the garrison from sinking into despair.

Malta.

These commissioners differed very widely in the accounts which they delivered at their return. Two of them thought it impossible to defend the fort much longer. But the third, named Constantine Castriot, a Greek prince, descended from the famous Albanian hero Scanderbeg, whether from ignorance or a consciousness of greater resources in his native courage than the other two possessed, maintained that the garrison was far from being reduced to the last extremity; and to give proof how firmly he was persuaded of the truth of what he said, he offered to enter the fort himself, and to undertake the defence of it with such troops as should be willing to accompany him;

The grand-master, strongly impressed with a sense of the necessity of protracting the siege, immediately accepted this offer, and bestowed the highest encomiums on Castriot's zeal and resolution. Nor did Castriot find any difficulty in persuading a sufficient number to attend him, who were no less zealous and resolute than himself. The soldiers crowded to his standard, and were emulous to have their names enrolled for that dangerous service in which he had engaged.

When la Valette saw the spirit by which these men were animated, and had no longer any doubt of being able by their means to prolong the siege of the fort; he sent a letter to the knights, acquainting them, that he was now willing to give them their discharge; and would immediately send another garrison, into whose hands he desired they should be ready to deliver up the fort, and come themselves to the town in the boats in which their successors were to be transported.

The contents and style of this letter affected the knights in the most sensible manner, and roused within them that delicate sense of honour by which the order had been so long and so eminently distinguished.—They resolved without hesitation to remain in the fort till every man should perish, rather than either deliver it to the new garrison or abandon it to the enemy. And they went in a body to the governor, and intreated him to inform the grand-master of their repentance, and to join with them in praying that they might be suffered to wipe out the remembrance of their fault by their future conduct.

The grand-master suffered himself at last to be overcome; and henceforth the garrison, dismissing all thoughts of their own safety, were intent on nothing but how to prolong the defence.

The grand-master sent them every night fresh troops to supply the place of the killed and wounded; and kept them well furnished with provisions, ammunition, and fire-works. Of these last he had invented a particular kind, which consisted of hoops of wood, covered with wool, and steeped in boiling oil and other inflammable liquors, mixed with nitre and gunpowder. To these machines they set fire, and threw them flaming in the midst of the enemy when they were crowded together at an assault. It happened often that two or three of the Turks were hooked together and scorched to death; and the utmost confusion was produced wherever they were thrown.

The besieged stood much in need of this, and every other instrument of mischief that could be devised, for their

14
Invention
of burning
ho. ps.

13
The knights
desire per-
mission to
leave the
fort, but
are refus-
ed.

Malta.

their defence. In spite of the most vigorous opposition, the Turks had cast a bridge over the ditch, and begun to sap and undermine the wall. From the 17th of June to the 14th of July, not a single day passed without some encounter; and Mustapha had frequently attempted to scale the wall of the fort, but had been as often repulsed with the loss of some of the bravest of his troops.

Aflamed at having been detained so long before a place of such inconsiderable strength, he resolved to make one great decisive effort; and to bring to the assault as many of his forces as the situation of the place would permit him to employ. He had already made several breaches; but in order to secure the success of the assault which he now intended, he kept his batteries playing all the 15th without intermission, till the wall on that side where he designed his attack was almost level with the rock. On the 16th, the fleet was drawn up before sunrise, as near the fort as the depth of the water would allow. Four thousand musketeers and archers were stationed in the trenches; and the rest of the troops, upon a signal given, advanced to the breach. The garrison was prepared to receive them; the breach was lined with several ranks of soldiers, having the knights interposed among them at certain distances. The Turks attempted often to break through this determined band, and to overpower them with their numbers; but their numbers served only to augment the loss which they sustained. Every shot from the fort did execution. The artillery made dreadful havoc among them; and the burning hoops were employed with astonishing success. The novelty of these machines, and the shrieks of those who were caught in them, added greatly to the terror which they inspired; and made it impossible for the Turkish officers to keep their men firm and steady in pursuing the advantages which, had they preserved their ranks, their numbers must have infallibly acquired.

At length Mustapha, after having continued the assault for more than six hours, without gaining a single inch of ground on the beleagured, gave orders for founding a retreat. In this attack the garrison lost about 20 knights and 300 soldiers; but this loss was immediately supplied by a reinforcement from the town; and Mustapha was at last convinced, that, unless the communication between the fort and the town were cut off, it would be impossible to bring the siege of the former to a period, while any troops remained in the other parts of the island. By the advice of Dragut, he resolved to extend his trenches and batteries on the side next the town, till they should reach to that part of the sea, or great harbour, where those supplies were landed which the grand-master daily sent to the garrison. This undertaking he knew must be attended with the utmost difficulty, because all the space between his intrenchments, and the point to which it was necessary to extend them, lay exposed to the artillery both of fort St Elmo and St Angelo. In viewing the ground, a Sangiaco, in whom he put confidence, was killed by his side; and, which was still a more irreparable loss, Dragut received a mortal wound, of which he died in a few days. This did not, however, discourage Mustapha from pursuing his design. By employing his troops and pioneers at the work day

N° 193.

Malta.

and night, without intermission, he at length carried it into execution. Then having planted batteries along the shore, and filled his trenches with musketeers, it was impossible for any boat to pass from the town to the fort without the most imminent danger of either being sunk or intercepted.

After this precaution, he resumed with fresh vigour his attempts to take the fort by storm. On the 21st he made four different assaults: all of which the garrison withstood; and, in repulsing so many thousand brave and well-disciplined troops, displayed a degree of prowess and fortitude which almost exceeds belief, and is beyond the power of description. But this heroic garrison was now exceedingly reduced in number; and there was the strongest reason to apprehend, that, in one assault more, they must inevitably be overpowered, unless a reinforcement were sent them from the town. Of their desperate situation they gave intelligence to the grand-master by one who swam across the harbour in the night. The boats were instantly filled with knights and other soldiers, who generously resolved to devote themselves to certain destruction for the general safety, and the preservation of the fort. They set off from the town with as much alacrity as if they had entertained the most sanguine hopes of victory; but they found the Turks every where so much upon their guard, and the lines so strongly defended, that, after several fruitless attempts to land, they were at last obliged to return, depressed with sorrow for the fate of their brave companions.

The garrison, now despairing of relief, gave themselves up for lost; but instead of either capitulating or attempting to escape, they prepared for death, and passed the night in prayer and in receiving the sacrament; after which they embraced one another tenderly, and then repaired to their respective posts; while such of the wounded as had been disabled from walking, were, at their own earnest desire, carried to the side of the breach, where they waited, without dismay, for the approach of the Turkish army.

Early in the morning of the 23d of July, the Turks advanced to the assault with loud shouts, as to certain victory, which they believed so small a handful of men as now remained in the fort would not dare to dispute with them. In this expectation they were disappointed. The garrison being resolved on death, and despising danger, were more than men; and exerted a degree of prowess and valour that filled their enemies with amazement. The combat lasted upwards of four hours, till not only every knight but every soldier had fallen, except two or three who had saved themselves by swimming. The Turkish colours were then planted on the ramparts; and the fleet entered the harbour, which the fort commanded, in a kind of triumph. When Mustapha took a view of the fort, and examined its size and fortifications, he could not refrain from saying, "What will not the father cost us (meaning the town), when the son, who is so small, has cost so many thousands of our bravest troops?" But this reflection, far from exciting his admiration of that heroic fortitude which he had found so difficult to overcome, served only to inspire him with a brutal fury. He ordered all such of the garrison as were found lying on the breach alive to be ripped open, and their hearts

15
The fort taken, and the garrison cut off.

16
Cruelty of Mustapha.

Malta.

Malta.

hearts torn out : and, as an insult on the knights and their religion, he caused their dead bodies to be searched for, and large gashes to be made in them, in the form of a cross; after which he tied them on planks, and threw them into the sea, to be carried by the wind and tide to the town or fort St Angelo.

The grand-master was at first melted into tears at this shocking spectacle; but his grief was soon converted into indignation and revenge: and these passions betrayed him into an action unworthy of the exalted character which he bore. In order to teach the *basia*, as he pretended; to make war with less barbarity, he caused all the Turks whom he had taken prisoners to be massacred; and then putting their heads into his largest cannon, he shot them into the Turkish camp.

In the siege which has been related, the order lost about 1500 men, including 130 of the bravest knights.

Mustapha vainly imagined, that, being intimidated by the fate of their companions, they would be now inclined to listen to terms of capitulation: and in this hope, he sent an officer with a white flag to one of the gates, attended by a Christian slave designed to serve for his interpreter. The Turk was not allowed to enter within the town; but the Christian was admitted, and was led through several ranks of soldiers under arms by an officer, who, after showing him all the fortifications of the place, desired him to take particular notice of the depth and breadth of the ditch, and said to him, " See there, the only spot we can afford your general; and there we hope soon to bury him and all his Janizaries."

This insulting speech being reported by the slave, excited in the fiery mind of the *basia* the highest degree of wrath and indignation, and made him resolve to exert himself to the utmost in the prosecution of the siege. His troops, though greatly diminished, were still sufficient to invest at once both the town and the fort of St Michael. He kept a constant fire on both; but he intended first to apply to the reduction of the latter, which he proposed to attack both by land and water, at the extremity of the peninsula on which it stands. In order to accomplish this design, it was necessary he should have some shipping introduced into the harbour for transporting his forces. But the mouth of the harbour having been rendered inaccessible by a great iron chain and the cannon of St Angelo, his design must have been relinquished, if Piali had not suggested an expedient against which the grand-master had not provided. This was, to make the Christian slaves and the crews of the ships draw a number of boats, by the strength of their arms, over the neck of land on which stood fort St Elmo. Of this proposal, which Mustapha immediately adopted, information was carried to the grand-master by a Turkish officer; who, being by birth a Greek, was touched suddenly with remorse, and deserted to the Christians. In consequence of this intelligence, La Valette set a great number of hands to work in framing a *flacado* along that part of the promontory where the Turks intended their attack; and at another part, where the depth of the water or the hardness of the bottom would not admit the *flacado*, he caused strong intrenchments to be made upon the

beach. Mustapha, in the mean time, fired incessantly upon the fort, while the slaves and crews were employed in transporting the boats over land into the harbour. At length the *basia*, judging that the number of boats which he had transported would be sufficient, and that the breaches which his artillery had made were practicable, resolved, without further delay, to make an attack both by sea and land. He was the more confident of success, as, since the taking of St Elmo, he had received a considerable reinforcement, by the arrival of Hascem, son of Barbarossa, with 2500 select soldiers, commonly called the *Braves of Algiers*. Hascem, who possessed a considerable share of his father's fire, and was ambitious to distinguish himself in the sultan's service, begged of Mustapha to intrust him with the assault of fort St Michael; and vaunted, with his natural arrogance, that he would soon make himself master of it sword-in-hand. The *basia*, whether from an opinion of his valour, or an intention to make him learn at his own expence the folly of his presumption, readily complied with his request; and, having added 6000 men to his Algerines, he promised to support him with the rest of his army.

Hascem divided his forces with Candellisa, an old corsair, his lieutenant; to whom he committed the attack by sea, whilst he reserved that on the land-side to himself.

Candellisa having put his troops on board the boats, set out with drums beating, and hautboys and other musical instruments playing, preceded by a boat filled with Mahometan priests, some of whom were employed in offering prayers to heaven for his success, or in singing hymns; while others had books in their hands, out of which they read imprecations against the Christians. Candellisa attempted first to break down the *flacado* which had been formed to obstruct his landing; but finding it much stronger than he expected, and that, while he was employed in demolishing it, his troops must suffer greatly from the enemy's fire, he thought it would be easier to make a descent on that part of the shore which the grand-master had strengthened with entrenchments. At this important post, the Christian troops were commanded by an ancient knight of the name of Guimeran. This experienced officer reserved his fire till the Turks had advanced within a little distance of the shore, when, by a single discharge, he killed about 400 men. This did not prevent the rest from approaching. Candellisa pushed forwards while the Christians were loading their cannon, and landed at the head of his Algerines. But Guimeran having reserved some cannon charged with grape-shot, did dreadful execution among them after they had landed, and many of them began to fly to their boats; which Candellisa observing, he commanded the boats to be put off to a little distance from the shore. His troops, perceiving then that they must either die or conquer, took courage from despair, and advanced boldly to the intrenchment, with ladders for scaling it in one hand and their sabres in the other. The combatants on both sides displayed the most intrepid valour. Great numbers fell, and the ditch was choked with blood, and with the bodies of the dead and wounded. The Turks at last, after an engagement of five hours, reached the top of the entrenchment,

18

The Turks
had ad-
repulsed
with a great
laughter.

Malta.

ment, and there planted their ensigns. The knights, stung with shame on account of their retreat, returned with redoubled ardour. But they would probably have been overpowered by the superior number of the enemy, had not the grand-master sent them a seasonable reinforcement, under the admiral de Giou and the chevalier de Quiney; who fell upon the Algerines and Turks with a degree of fury that struck terror into Candellisa himself, who was noted for his intrepidity. Having ordered the boats to be brought nearer the shore, he was among the first who fled. His braves fought desperately for some time after he had left them; but were at length thrown down from the intrenchments, and compelled to fly to their boats with the utmost precipitation. The Christians pursued them, and the batteries continued firing on them without intermission. Many of the boats were sunk; the water was covered with dead bodies, mangled limbs, shields, and helmets. Of the 4000 who had been sent on this enterprise, scarcely 500 remained, and many of these were dangerously wounded.

Hafsem was not more fortunate in his assault by land than Candellisa was by sea. After having been repulsed at one breach with great slaughter, he rallied his troops, and led them on to another, where he fought long and desperately, till, most of the braves having fallen by his side, he was obliged, with much reluctance and sorrow, to found a retreat.

Mustapha, not unmindful of his promise to support him, no sooner perceived him beginning to retire, than he ordered the Janisaries, whom he kept under arms, to advance. The garrison had maintained an engagement with Hafsem for five hours, in the middle of the day, and in the hottest season of the year; yet, as if they had not been subject to the wants and weaknesses of humanity, they advanced beyond the breach to meet the Janisaries, and fought apparently with as much vigour and fortitude as before. By the power of superior numbers, they were compelled to fall back within the breach. But there they made the most desperate resistance; and, being reinforced by De Giou and De Quiney, with the troops which had triumphed over Candellisa, they at last repulsed the Janisaries with dreadful slaughter; after having lost more than 40 knights, and 200 of the bravest of the common men.

Mustapha, enraged by this invincible obduracy which the Christians displayed in their defence, and dreading that the Spanish succours, which had been already delayed much longer than he expected, might soon arrive, resolved now to employ his whole force at once; and while he himself prosecuted the siege of fort St Michael with one half of his troops, to employ the other, under Piali, against the town. More batteries were raised; the trenches were advanced still nearer than before; bridges of sail-yards and masts were thrown over the ditches; mines, notwithstanding the hard and rocky soil, were sprung; assaults were repeated without number; and the two basbas, emulous of one another, and each of them agitated with continual anxiety lest victory should declare first for his competitor, exhibited the most shining proofs of personal courage, and exhausted all the art of war then known in the world. Yet, through the determined bravery of the knights, conducted by the grand-mas-

ter with consummate prudence and indefatigable vigilance, the Turks were baffled in every attempt, and repulsed with slaughter. Mustapha flattered himself once with the most sanguine hopes of success on his number of part, from a machine invented by his principal engineer, in the form of a huge cake bound strongly with iron hoops, and filled with gunpowder, nails, chains, vane of bullets, and such other instruments of death. After their own setting fire to a train which was fastened to this machine, it was thrown, by the force of an engine, upon a ravelin that was the principal defence of the fort. But the garrison, undiminished, found means, before it caught fire, to cast it out again into the midst of the assailants. In a moment afterwards it burst with dreadful fury, and filled the Turks with consternation. The knights then sallied out upon them sword-in-hand; and, taking advantage of their confusion, killed many of them, and put the rest to flight.

Piali had, on some occasions, still more reason than Mustapha to entertain the hopes of victory, although the town was much stronger than the fort and La Vallette commanded there in person. By his batteries he had demolished all the out-works of the place, and had made an immense breach in the wall. While his troops were engaged in a furious assault, that engrossed the whole attention of the besieged from morning till night, he employed a great number of pioneers in raising a cavalier or platform of earth and stones, close by the breach, and so high as to overlook the parapet. Night, in the mean time, came on, and prevented him from carrying any further this great advantage; but he doubted not that next day he should be able to make himself master of the place.

As soon as he had drawn off his forces, a council of the grand-master presided, and most of the knights were of opinion that the town was no longer tenible; that the fortifications which still remained should be blown up; and that the garrison and inhabitants should retire into the castle of St Angelo. But the grand-master received this proposal with horror and indignation.

"This would be in effect (said he) to deliver the whole island into the hand of the infidels. Fort St Michael, which has been so gallantly defended, and which is preserved by its communication with the town, would thus be soon reduced to the necessity of surrendering. There is no room in the castle of St Angelo for the inhabitants and troops; nor, if there were room, is there water in that fort for so great a number." It was then proposed, that at least the relics of the saints and the ornaments of the churches should be carried into the castle; and the knights earnestly treated the grand-master to retire into it himself, assuring him that they would conduct the defence with the utmost vigour and vigilance. "No, my brethren (he replied), what you propose as to the sacred things would serve only to intimidate the soldiers. We must conceal our apprehensions. It is here we must either die or conquer. And is it possible that I, at the age of 71, can end my life so honourably as in fighting, together with my friends and brethren, against the implacable enemies of our holy faith? He then told them what he thought proper to be done, and proceeded instantly to put it into execution. Having called all the soldiers from fort St Angelo, except a few who were necessary for managing the artillery, he employed them

20
Incredible
valour of
the Mal-
tese.

27

The grand-
master pre-
sides the
knights
from aban-
doning the
town.

them and the inhabitants all night in throwing up intrenchments within the breach; after which he sent out some of the bravest knights, with a select body of troops, to make an attempt on the cavalier. These men stole softly along the foot of the wall till they arrived at the place appointed; when they set up a loud shout, and attacked the guards whom Piali had left there with so much fury, that the Turks, believing the whole garrison had fallen upon them, abandoned their post, and fled precipitately to their camp.

The cavalier was immediately fortified, a battery of cannon planted on it, and a parapet raised on the side towards the enemy. And thus the breach was rendered impracticable; the town put in greater security than before; and a work, which had been devised for its destruction, converted into a bulwark for its defence.

The grand-master had now greater confidence than ever of being able to hold out till the Spaniards should come to his relief. In consequence of the assurances given by Philip and the Sicilian viceroy, he had, long before this time, entertained the hopes of their arrival; and had often earnestly solicited the viceroy to hasten his departure from Messina. The conduct of this nobleman was long exceedingly mysterious. The patience of the knights was worn out by his delays; and they, and many others, suspected that the real motive of his conduct was the dread of encountering with an admiral of so considerable reputation as Piali. But it afterwards appeared that the viceroy had acted agreeably to his instructions from the court of Spain. For although Philip was, for the reasons above mentioned, sincerely interested in the preservation of the knights, and had amused them with the most flattering promises of assistance; yet he seems from the first to have resolved not to expose himself to danger on that account, and to avoid if possible a general engagement.

23
Ungrateful
and ungenerous conduct
of the king of
Spain.

A generous and grateful prince would have acted very differently towards an ally so deserving of his support; and if either generosity or gratitude had been the leading principle of Philip's conduct, it is probable he would, on this occasion, have regarded the knights as his own subjects; and have thought it no less incumbent on him to exert himself in their defence, than if they had acknowledged him as their sovereign.

But Philip was affected by their danger only so far as it threatened the tranquillity of his own dominions. He had resolved to interpose in their behalf, rather than to suffer them to be overpowered; but he appears to have been very little touched with their calamities, and to have intended to leave them to themselves, as long as there was any prospect of their being able to make resistance; by doing which he considered, that he would not only preserve his own strength entire, but might afterwards engage with the Turks when they were exhausted by the operations of the siege.

Philip adhered inflexibly to this plan, notwithstanding the grand-master's repeated importunities, much longer than was consistent with his own selfish views. For, without a degree of fortune and prowess on the part of the garrison, and a degree of wisdom, vigilance, and magnanimity on that of the grand-master, infinitely higher than there could be reason to expect, it must have been impossible for such a handful of men to have withstood, for so long a time, so great a force,

and such mighty efforts, as were employed to reduce them. Even the death of the grand-master alone, whose person was exposed to perpetual danger, would have proved fatal to the knights, long before Philip sent orders to his viceroy to give them any effectual support; and in this case, as his own dominions or his fleet would have been immediately attacked, he would probably have had little reason to be satisfied with the timid ungenerous counsels which he pursued.

Whatever judgment may be formed on this head, the viceroy did not think himself at liberty to yield to the repeated applications of the grand-master, till the operations of the siege began to relax, and the Turkish forces were reduced from 15,000 to 15,000 or 16,000; of whom many were worn out with the fatigues which they had undergone, and others rendered unfit for action by a bloody flux, which for several weeks had raged amongst them.

In this situation of affairs, when it was probable that the knights would, without assistance, have compelled the Turks to raise the siege, the viceroy let the grand-master know, that he had now received such instructions from the king, as put it in his power to show his attachment to the order: that he was not indeed permitted to attack the Turkish fleet; but that he would immediately bring him a strong body of troops, whose commanders (as he himself must return to Sicily) were to be entirely subject to the grand-master's authority till the enemy should be expelled.

The viceroy, altho' still suspected of interposing unnecessary delays, at length fulfilled his promise; and on the 7th of September landed 6000 men, under Don Alvaro de Sande and Afcanio della Cora, in that part of the island which lay at the greatest distance from the Turks; after which, he immediately carried back the fleet to Sicily.

In the mean time, intelligence being brought to Mustapha that the Spaniards were landed, and marching towards him, he was thrown into the most dreadful consternation. Sensible that his soldiers were much disheartened by their ill success, he imagined that he was about to be attacked by a superior army, consisting of the bravest and best disciplined troops in Spain.

Without waiting for information of their number, he forthwith raised the siege, drew his garrison out of St Elmo, and, leaving all his heavy cannon behind him, embarked his troops with as much precipitation as if he were the Spaniards with superior forces had been in sight.

He had scarcely got on board when a deserter arrived from the Spanish camp, and informed him, that with 15,000 or 16,000 men, he had fled before an army that did not exceed 6000, having no general at their head, and commanded by officers who were independent of one another. The basha was overwhelmed with shame and vexation by this intelligence, and would have immediately disembarked; but this, he knew, he durst not attempt without consulting Piali, Haccem, and his other principal officers.

While he was deliberating upon it, the grand-master improved to the best advantage the leisure that was afforded him. He employed all the inhabitants, men, women, and children, as well as the soldiers, in filling up the enemy's trenches, and demolishing their works; and put a garrison without delay into fort St Elmo; in which the Turks now beheld from their ships the standard

23

The knights receive a reinforcement.

24

The Turks raise the siege in a panic.

Malta.

dard of St John erected, where that of Mahomet had lately stood.

This demonstrated to Mustapha how much new labour awaited him in case he should return to the siege; but being enraged against himself on account of the precipitancy of his retreat, and disquieted at the thoughts of the reception which he had reason to expect from Solymán, he wished to atone for his imprudence, and to wipe off the reproach in which it had involved him, by victory or death. Piali, who, from his jealousy of the basha's credit with the sultan, was not sorry for the failure of his enterprise, represented in a council of war convened on this occasion, That as the troops were much dispirited and worn out, it would be exposing them to certain destruction, either to lead them against the enemy, or to resume the operations of the siege. But a majority of the council were of a different opinion; and it was resolved to land the forces again without delay.

as
They re-
turn, but
are defeat-
ed.

The Turkish soldiers complained bitterly of this unexpected resolution, and obeyed the orders to disembark with the greatest reluctance. Their officers were obliged to employ threats with some and force with others. At length the number intended was put on shore, and Mustapha set out at their head in search of the enemy.

The grand-master had not neglected to give early notice of their march to the Spanish commanders, who had intrenched their little army on a steep hill, which the Turks would have found almost inaccessible; and it was the opinion of some of the principal officers, that they should avail themselves of the advantage of their situation, and stand on their defence. But this proposal was rejected with disdain by the bold adventurous De Sande, and the greatest part of the Spanish officers; and the troops were led out of their encampment, to meet the enemy in the open field. This conduct, more fortunate perhaps than prudent, contributed to increase the dejection of the Turkish soldiers, and to facilitate their defeat. Having been dragged against their inclination to the field of battle, and being attacked by the Spaniards with great fury, both in front and flank, they scarcely fought, but, being struck with a sudden panic, fled with the utmost precipitation.

Mustapha, confounded and enraged by this pusillanimous behaviour of his troops, was hurried along by the violent tide of the fugitives. He fell twice from his horse, and would have been taken prisoner if his officers had not rescued him. The Spaniards pursued briskly till they came to the sea-shore. There Piali had his boats ready to receive the Turks, and a number of shallops filled with musketeers drawn up to favour their escape. Without this precaution, they must all have perished; and, even notwithstanding the protection which it afforded them, the number of their killed amounted to 2000 men, while the victors lost only 13 or 14 at most.

Such, after four months continuance, was the conclusion of the siege of Malta, which will be for ever memorable on account of that extraordinary display of the most generous and heroic valour by which the knights, so few in number, were enabled to baffle the most vigorous efforts which could be made to subdue them by the most powerful monarch in the world. The

news of their deliverance gave universal joy to the Christian powers; and the name of the grand-master excited every where the highest admiration and applause. Congratulations were sent him from every quarter; and in many states public rejoicings were celebrated on account of his success.

With this siege is concluded every thing of importance in the history of Malta. The power of the Turks began about this time to be so much circumscribed, that they ceased to be formidable to the Christian nations, and the knights of Malta had no longer an opportunity of exerting their valour as formerly. They have remained ever since in quiet possession of their island, of which the best description we have met with is that given by Mr Brydone.

“The approach of the island (says he) is very fine, although the shore is rather low and rocky. It is everywhere made inaccessible to an enemy by an infinite number of fortifications. The rock, in many places, has been sloped into the form of a glacis, with strong parapets and intrenchments running behind it.—On getting ashore we found ourselves in a new world indeed.—The streets (of Valetta) crowded with well-dressed people, who have all the appearance of health and affluence; and we were conducted by the English consul to an inn, which had more the appearance of a palace.”

26
Description
of the
Island, &c.

“After dinner we went to visit the principal villas of the island; particularly those of the grand-master and the general of the galleys, which lie contiguous to one another. There are nothing great or magnificent; but they are admirably contrived for a hot climate, where, of all things, shade is the most desirable. The orange-groves are indeed very fine, and the fruit they bear superior to any thing of the kind in Spain or Portugal.

“The aspect of the country is far from being pleasing: the whole island is a great rock of very white freestone; and the soil that covers this rock is, in most places, not more than five or six inches deep; yet, what is singular, we found their crop in general was exceedingly abundant. They account for it from the copious dews that fall during the spring and summer months; and pretend likewise that there is a moisture in the rock below the soil, that is of great advantage to the corn and cotton, keeping its roots perpetually moist and cool: without which singular quality, they say, they could have no crop at all, the heat of the sun being so exceedingly violent.—The whole island produces corn only sufficient to supply its inhabitants for five months or little more; but the crop they most depend upon is the cotton. They begin to sow it about the middle of May, and continue till the middle of June; and the time of reaping is in the month of October and beginning of November.

“They pretend that the cotton produced from this plant, which is sown and reaped in four months, is of a much superior quality to that of the cotton-tree. I compared them; but I cannot say I found it so: this is indeed the finest; but that of the cotton-tree is by much the strongest texture. The plant rises to the height of a foot and an half; and is covered with a number of nuts or pods full of cotton: These, when ripe, they are at great pains to cut off every morning before sun-rise; for the heat of the sun immediately

turns.

Malta. turns the cotton yellow; which indeed we saw from those pods they save for seed.

"They manufacture their cotton into a great variety of stuffs. Their stockings are exceedingly fine. Some of them, they assured us, had been sold for ten sequins a-pair. Their coverlets and blankets are esteemed all over Europe. Of these the principal manufactures are established in the little island of Gozzo, where the people are said to be more industrious than those of Malta, as they are more excluded from the world, and have fewer inducements to idleness. Here the sugar-cane is still cultivated with success, though not in any considerable quantity.

"The Maltese oranges certainly deserve the character they have of being the finest in the world. The season continues for upwards of seven months, from November till the middle of June; during which time those beautiful trees are always covered with abundance of delicious fruit. Many of them are of the red kind, much superior, in my opinion, to the others, which are rather too luscious. They are produced, I am told, from the common orange-bud, ingrafted on the pomegranate stock. The juice of this fruit is as red as blood, and of a fine flavour. The greatest part of their crop is sent in presents to the different courts of Europe, and to the relations of the chevaliers.

The industry of the Maltese in cultivating their little island is inconceivable. There is not an inch of ground lost in any part of it; and where there was not soil enough, they have brought over ships and boats loaded with it from Sicily, where there is plenty, and to spare. The whole island is full of inclosures of free-stone, which give the country a very uncouth and barren aspect; and in summer reflects such a light and heat, that it is exceedingly disagreeable and offensive to the eyes. The inclosures are very small and irregular, according to the inclination of the ground. This, they say, they are obliged to observe, notwithstanding the deformity it occasions; otherwise the floods, to which they are subject, would soon carry off their soil.

"The island is covered over with country-houses and villages, besides seven cities, for so they term them; but there are only two, the Valetta, and Citta Vecchia, that by any means deserve that appellation. Every little village has a noble church, elegantly finished, and adorned with statues of marble, rich tapestry, and a large quantity of silver-plate.

"The city of Valetta has certainly the happiest situation that can be imagined. It stands upon a peninsula between two of the finest ports in the world, which are defended by almost impregnable fortifications. That on the south side of the city is the largest. It runs about two miles into the heart of the island; and is so very deep, and surrounded by such high grounds and fortifications, that they assured us the largest ships of war might ride here in the most stormy weather, almost without a cable.

"This beautiful basin is divided into five distinct harbours, all equally safe, and each capable of containing an immense number of shipping. The mouth of the harbour is scarcely a quarter of a mile broad, and is commanded on each side by batteries that would tear the strongest ship to pieces before she could

enter. Besides this, it is fronted by a quadruple battery, one above the other, the largest of which is a *flour d'eau*, or on a level with the water. These are mounted with about 80 of their heaviest artillery: so that this harbour, I think, may really be considered as impregnable; and indeed the Turks have ever found it so, and I believe ever will.

"The harbour on the north side of the city, although they only use it for fishing, and as a place of quarantine, would, in any other part of the world, be considered as inestimable. It is likewise defended by very strong works; and in the centre of the basin is an island on which they have built a castle and a lazaret.

"The fortifications of Malta are indeed a most stupendous work. All the boasted catacombs of Rome and Naples are a trifle to the immense excavations that have been made in this little island. The ditches, of a vast size, are all cut out of the solid rock. These extend for a great many miles, and raise our astonishment to think that so small a state has ever been able to make them.

"One side of the island is so completely fortified by nature, that there was nothing left for art. The rock is of a great height, and absolutely perpendicular from the sea for several miles. It is very singular, that on this side there are still the vestiges of several ancient roads, with the tracks of carriages worn deep in the rocks. These roads are now terminated by the precipice, with the sea beneath; and show, to a demonstration, that this island has formerly been of a much larger size than it is at present; but the convulsion that occasioned its diminution is probably much beyond the reach of any history or tradition. It has been often observed, notwithstanding the very great distance of mount *Ætna*, that this island has generally been more or less affected by its eruptions; and they think it probable, that on some of these occasions a great part of it may have been shaken into the sea.

"One half of mount *Ætna* is clearly discovered from Malta. They reckon the distance near 200 Italian miles. And the people of Malta affirm, that, in great eruptions of the mountain, their whole island is illuminated, and from the reflection in the water there appears a great track of fire all the way from Malta to Sicily. The thundering of the mountain is likewise distinctly heard.

"We made an expedition through the island in coaches drawn by one mule each; the only kind of vehicle the island affords. The catacombs, not far from the ancient city of Melita, are a great work: they are said to extend for 15 miles under-ground. Many people, they assure us, have been lost in them by advancing too far; the prodigious number of branches making it next to impossible to find the way out again. The great source of water that supplies the city of Valetta takes its rise near to this place; and there is an aqueduct, composed of some thousand arches, that conveys it from thence to the city. The whole of this immense work was finished at the private expence of one of the grand-masters.

"Not far from the old city there is a small church dedicated to St Paul; and just by the church a miraculous statue of the saint, with a viper on his hand, supposed to be placed on the very spot where the house
stood.

Malta.

Malta.

flood in which he was received after his shipwreck on the island, and where he shook the viper off his hand into the fire without being hurt by it: at which time the Maltese assure us, the faint cursed all the venomous animals of the island, and banished them for ever. Whether this be the cause of it or not, the fact is certain that there are no venomous animals in Malta. They assured us, that vipers had been brought from Sicily, and died almost immediately on their arrival.

“ Adjoining to the church is the celebrated grotto in which the faint was imprisoned. It is looked upon with the utmost reverence and veneration; and if the stories they tell of it be true, it is well entitled to it all. It is exceedingly damp, and produces (I believe by a kind of petrification from the water) a whitish-kind of stone, which, they assure us, when reduced to powder, is a sovereign remedy in many diseases, and saves the lives of thousands every year. There is not a house in the island that is not provided with it: and they tell us there are many boxes of it sent annually, not only to Sicily and Italy, but likewise to the Levant, and to the East Indies; and (what is considered as a daily standing miracle) notwithstanding this perpetual consumption, it has never been exhausted, nor even sensibly diminished; the faint always taking care to supply them with a fresh quantity the day following. I tasted some of it, and believe it is a very harmless thing. It tastes like exceeding bad magnesia, and, I believe, has pretty much the same effects. They give about a tea-spoonful of it to children in the small-pox and in fevers. It produces a copious sweat about an hour after, and, they say, never fails to be of service. It is likewise esteemed a certain remedy against the bite of all venomous animals. There is a very fine statue of St Paul, in the middle of this grotto, to which they ascribe great powers.

“ The grand-master of the knights of Malta is more absolute, and possesses more power, than most sovereign princes. His titles are, *serene highness* and *eminence*; and his household-attendance and court are all very princely. As he has the disposal of all lucrative offices, he makes of his councils what he pleases; besides, in all the councils that compose the jurisdiction of this little nation, he himself presides, and has two votes. He has the disposal of 21 commanderies, and one priory, every five years; and as there is always a number of expectants, he is very much courted. He is chosen by a committee of 21; which committee is nominated by the seven nations, three out of each nation. The election must be over within three days of the death of the former grand-master; and, during these three days, there is scarce a soul that sleeps at Malta: it is cabal and intrigue; and most of the knights are muffled, to prevent their particular attachments and connections from being known: the moment the election is over, every thing returns to its former channel.

“ The land-force of Malta is equal to the number of men in the island fit to bear arms. They have about 500 regulars belonging to the ships of war; and 150 compose the guard of the prince. The two islands of Malta and Gozzo contain about 150,000 inhabitants. The men are exceeding robust and hardy. I have seen them row for 10 or 12 hours without intermission, and without even appearing to be fatigued. Their sea-force

consists of 4 gallees, 3 galliots, 4 ships of 60 guns, and a frigate of 36, besides a number of the quick-sailing little vessels called *scampavias* (literally *runaways*). Their ships, galleys, and fortifications, are not only well supplied with excellent artillery, but they have likewise invented a kind of ordnance of their own, unknown to all the world besides. For we found, to our no small amazement, that the rocks were not only cut into fortifications, but likewise into artillery, to defend these fortifications, being hollowed out, in many places, into the form of immense mortars. The charge is said to be about a barrel of gunpowder, over which they place a large piece of wood, made exactly to fit the mouth of the chamber. On this they heap a great quantity of cannon balls, shells, or other deadly materials; and when an enemy's ship approaches the harbour, they fire the whole into the air: and they pretend it produces a very great effect; making a shower for 200 or 300 yards round, that would sink any vessel.

“ Notwithstanding the supposed bigotry of the Maltese, the spirit of toleration is so strong, that a mosque has been lately built for their sworn enemies the Turks. Here the poor slaves are allowed to enjoy their religion in peace. It happened lately that some idle boys disturbed them during their service; they were immediately sent to prison, and severely punished. The police indeed is much better regulated than in the neighbouring countries, and assassinations and robberies are very uncommon; the last of which crimes the grand-master punishes with the utmost severity. He is said to be much more relaxed with regard to the first.

“ Perhaps Malta is the only country in the world where duelling is permitted by law. As their whole establishment is originally founded on the wild and romantic principles of chivalry, they have ever found it too inconsistent with those principles to abolish duelling; but they have laid it under such restrictions as greatly to lessen its danger. These are curious enough. The duellists are obliged to decide their quarrel in one particular street of the city; and if they presume to fight any where else, they are liable to the rigour of the law. But, what is not less singular, but much more in their favour, they are obliged, under the most severe penalties, to put up their swords when ordered to do so by a *woman*, a *priest*, or a *knight*. Under these limitations, in the midst of a great city, one would imagine it almost impossible that a duel could ever end in blood; however, this is not the case: a cross is always painted opposite to the spot where a knight has been killed, in commemoration of his fall. We counted about 20 of these crosses.

“ About three months ago (Mr Brydons's letter is dated June 7. 1770), two knights had a dispute at a billiard-table. One of them, after giving a great deal of abusive language, added a blow; but, to the astonishment of all Malta (in whose annals there is not a similar instance, after so great a provocation, he absolutely refused to fight his antagonist. The challenge was repeated, and he had time to reflect on the consequences; but still he refused to enter the lists. He was condemned to make the *amende honorable* in the great church of St John for 45 days successively; then to be confined in a dungeon, without light, for five years; after which, he is to remain a prisoner in the castle for life.

Malta.

life. The unfortunate young man who received this blow is likewise in disgrace, as he has not had an opportunity of wiping it out in the blood of his adversary.

"The horse-races of Malta are of a very uncommon kind. They are performed without either saddle, bridle, whip, or spur; and yet the horses are said to run full speed, and to afford a great deal of diversion. They are accustomed to the ground for some weeks before; and although it is entirely over rock and pavement, there are very seldom any accidents. They have races of asses and mules performed in the same manner four times every year. The rider is only furnished with a machine like a shoemaker's awl, to prick on his courser if he is lazy.

"As Malta is an epitome of all Europe, and an assemblage of the younger brothers, who are commonly the best, of its first families, it is probably one of the best academies for politeness in this part of the globe; besides, where every one is entitled by law as well as custom to demand satisfaction for the least breach of it, people are under a necessity of being very exact and circumspect, both with regard to their words and actions."

Knights of MALTA, otherwise called *Hospitallers of St John of Jerusalem*, a religious military order, whose residence is in the island of Malta, situated in the Mediterranean sea, upon the coast of Africa. The Knights of Malta, so famous for defending Christendom, had their rise as follows:

Some time before the journey of Godfrey of Bouillon into the Holy Land, some Neapolitan merchants, who traded in the Levant, obtained leave of the caliph of Egypt to build an house for those of their nation who came thither on pilgrimage, upon paying an annual tribute. Afterwards they built two churches, and received the pilgrims with great zeal and charity. This example being followed by others, they founded a church in honour of St John, and an hospital for the sick; whence they took the name of *Hospitallers*. A little after Godfrey of Bouillon had taken Jerusalem, in 1099, they began to be distinguished by black habits and a cross with eight points; and, besides the ordinary vows, they made another, which was to defend the pilgrims against the insults of the infidels. This foundation was completed in 1104, in the reign of Baldwin; and so their order became military, into which many persons of quality entered, and changed the name of *hospitallers* into that of *knights*.

When Jerusalem was taken, and the Christians lost their power in the East, the knights retired to Acre or Ptolemais, which they defended valiantly in 1290. Then they followed the king of Cyprus, who gave them Limiffon in his dominions, where they staid till 1310. That same year they took Rhodes, under the grand-master Poulques de Villaret, a Frenchman; and next year defended it against an army of Saracens: since which the grand-masters have used these four letters, F. E. R. T. i. e. *Fortitudo ejus Rhodum tenuit*; and the order was from thence called *knights of Rhodes*.

In 1522, Soliman having taken Rhodes, the knights retired into Candia, and thence into Sicily. In 1530, Charles V. gave them the island of Malta, to cover his kingdom of Sicily from the Turks. In 1566, Soliman besieged Malta; but it was gallantly defended by

the grand-master John de Valette Parifot, and the Turks obliged to quit the island with great loss.

The knights consisted of eight different languages or nations, of which the English were formerly the sixth; but at present they are but seven, the English having withdrawn themselves. The first is that of Provence, whose chief is grand commendator of religion; the second, of Auvergne; whose chief is marshal of the order; the third, of France, whose chief is grand-hospitaler; the fourth, of Italy; and their chief, admiral; the fifth, of Arragon; and their chief, grand-conservator; the sixth, of Germany; and their chief, grand-bailiff of the order; the seventh, of Castile; and their chief, grand-chancellor. The chief of the English was grand-commander of the cavalry.

None are admitted into this order but such as are of noble birth both by father and mother's side for four generations, excepting the natural sons of kings and princes. The knights are of two sorts; those who have a right to be candidates for the dignity of grand-master, called *grand-crosses*; and those who are only *knights-assistants*, who are taken from good families. They never marry; yet have continued from 1090 to the present time.

The order consists of three estates; the knights, chaplains, and servants at arms. There are also priests who officiate in the churches; friar-servants, who assist at the offices; and *donnes*, or *demi-crosses*; but these are not reckoned as constituent parts of the body. This division was made in 1130, by the grand-master Raymond du Puy.

The government of the order is mixed, being partly monarchical, and partly aristocratical. The grand-master is sovereign, coins money, pardons criminals, and gives the places of grand-priors, bailiffs, knights, &c. The ordinary council is composed of the grand-master and the grand-crosses. Every language has several grand-priories, and every priory a certain number of commanderies.

The knights are received into this order, either by undergoing the trials prescribed by the statutes, or by dispensation. The dispensations are obtained either by the pope's brief, or by a general chapter of the order, and are granted in case of some defect as to the nobility of their pedigree, especially on the mother's side. The knights are received, either as of age, under minority, or pages to the grand-master. They must be 16 years old complete before they are received: they enter into the novitiate at 17, and are professed at 18. They sometimes admit infants of one year old; but the expence is about 4000 livres. The grand-master has 16 pages who serve him, from 12 to 16 years of age. The knights wear on the left-side of their cloak or waistcoat a cross of white waxed cloth, with eight points, which is their true badge; that of gold being only for ornament. When they go to war against the Turks, they wear a red cassock, with a great white cross before and behind, without points, which are the arms of the religion. The ordinary habit of the grand-master is a sort of cassock of tabby-cloth, tied about with a girdle, at which hangs a great purse, to denote the charitable institution of the order. Over this he wears a velvet gown; and on the left side a white cross with eight points. His yearly revenue is 10,000 ducats. He acknowledges the kings of Spain, and

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Malon
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Malvern.

both the Sicilies, as his protectors; and is obliged, by his agreement with the emperor Charles V. to suppress pirates.

MALTON, a town of the north-riding of Yorkshire in England, seated on the river Derwent, over which there is a good stone-bridge. It is composed of two towns, the New and the Old; and is well inhabited, accommodated with good inns, and sends two members to parliament. W. Long. *o. 30. N. Lat. 54. 8.*

MALVA, the MALLOW: A genus of the polyandria order, belonging to the monadelphia class of plants; and in the natural method ranking under the 37th order, *Columifera*. The calyx is double; the exterior one triphyllous; the arilli numerous and monospermous. There are 24 species; consisting of herbaceous perennials, biennials, and annuals, for medicinal, economical, and ornamental uses; rising with erect stalks from about half a yard to 10 or 12 feet high, garnished with large, roundish, lobated leaves, and quinquepetalous flowers. They are all easily and plentifully raised from seed.

The leaves of the common mallow are reckoned the first of the four emollient herbs: they were formerly in some esteem as food, for loosening the belly; at present, decoctions of them are sometimes employed in dysenteries, heat, and sharpness of urine; and, in general, for obtaining acrimonious humours: their principal use is in emollient glysters, cataplasms, and fomentations. The leaves enter the official decoction for glysters, and a conserve is prepared from the flowers.

Several species of malva, macerated like hemp, afford a thread superior to hemp for spinning, and which is said to make more beautiful cloths and stuffs than even flax. These species are the *cripa*, *Peruviana*, and *Mauritiana*. From the former, which affords stronger and longer fibres, cords and twine have also been made. From the *malva*, likewise, a new sort of paper has been fabricated by M. de l'Isle. On this invention, Mess. Lavoisier, Sage, and Berthollet, in name of the *Académie des Sciences*, observe, That "it is not probable the paper made by M. de l'Isle will be substituted for that made from rags, either for the purpose of printing or writing. Yet paper from the mallows may be used for these purposes, if we can judge from a volume printed on it presented to the academy. The great utility of M. de l'Isle's invention is for furniture, which consumes a great quantity of rags; and his papers have a natural hue, much more solid than can be given by colouring matter, and this hue may serve as a ground for other drawings. M. de l'Isle should, we think, be encouraged to pursue his experiments, which, we have reason to expect, may be in the end very useful: by his zeal, activity, and knowledge, he will probably contribute to render the art of making paper more perfect; in this art he is much engaged; and his attempts, which he has shown to the academy, merit its praises."

MALVERN, GREAT and LITTLE, (with the *Chace* and the *Hills*); two towns of Worcesterhire, in which were formerly two abbeys, about three miles asunder. Since the dissolution nothing remains of the abbey of *Great Malvern* but the gateway of the abbey and church, now parochial. Part of it was a religious cell for hermits before the Conquest; and the

Malvern
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Mambrun.

greatest part, with the tower, built in the reign of William the Conqueror. Its outward appearance is very striking. It is 171 feet in length, 63 in breadth, and 63 in height. In it are ten stalls; and it is supposed to have been rebuilt in the year 1171. The nave only remains in part, the side aisles being in ruins. The windows have been beautifully enriched with painted glass, and in it are remains of some very ancient monuments. *Little Malvern* stands in a cavity of the hills, which are great lofty mountains, rising like fairs, one higher than another, for about eleven miles, and divide this county from Herefordshire. There is a ditch here very much admired. On the hills are two medicinal springs, called *boly wells*, one good for the eyes, and the other for cancers. Henry VII. his queen, and his two sons prince Arthur and prince Henry, were so delighted with this place, that they beautified the church and windows, part of which remain, though mutilated. In the lofty south windows of the church are the historical passages of the Old Testament; and in the north windows the pictures of the holy family, the nativity and circumcision of our Saviour, the adoration of the shepherds and the kings, his presentation in the temple, his baptism, falling, and temptation, his miracles, his last supper with his disciples, his prayer in the garden, his passion, death, and burial, his descent into hell, his resurrection and ascension, and the coming of the Holy Ghost. The history of our Saviour's passion is painted differently in the east window of the choir, at the expense of Henry VII. whose figure is therefore often represented, as is that of his queen. In the west window is a noble piece of the day of judgment, not inferior to the paintings of Michael Angelo. *Malvern Chase* contains 7115 acres in Worcesterhire (besides 241 acres called the Prior's Land), 619 in Herefordshire, and 103 in Gloucesterhire. *Malvern Hills* run from north to south, the highest point 1313 feet above the surface of the Severn at Hanley, and appear to be of lime-stone and quartz. On the summit of these hills is a camp with a treble ditch, imagined to be Roman, and is situated on the Herefordshire side of the hills.

MALVEZZI (Virgilio marquis de), an Italian gentleman, born at Bologna, acquired great reputation by his learning and writings. He was well versed in polite literature, music, law, physic, and the mathematics. He served also in a distinguished post in the army of Philip IV. king of Spain, and was employed by him in some important negotiations. He died at Bologna in the year 1654, leaving several works in Spanish and Italian. Among the latter are his Discourses on the First Book of Tacitus: this work has been translated into English.

MALUS, in botany. See *PRUNUS*.

MAMALUKES, the name of a dynasty that reigned in Egypt. See that article, n^o 98.

MAMBRUN (Peter), an ingenious and learned French Jesuit, born in the diocese of Clermont, in the year 1581. He was one of the most perfect imitators of Virgil in Latin poetry, and his poems are of the same species: Thus he wrote *Echlogues*; *Georgics*, or four books on the culture of the soul and the understanding; together with a heroic poem intitled *Constantine, or Idolatry overthrown*. He showed also great critical

Mamertini critical abilities in a Latin *Peripatetical dissertation on epic poetry*. Headed in 1661.

MAMERTINI, a mercenary band of soldiers which passed from Campania into Sicily at the request of Agathocles. When they were in the service of Agathocles, they claimed the privilege of voting at the election of magistrates at Syracuse, and had recourse to arms to support their unlawful demands. The sedition was appeased by the authority of some leading men, and the Campanians were ordered to leave Sicily. In their way to the coast they were received with great kindness by the people of Messina, and soon returned perfidy for hospitality. They conspired against the inhabitants, murdered all the males in the city, married their wives and daughters, and rendered themselves masters of the place. After this violence they assumed the name of Mamertini, and called their city Mamertum, or Mamertium, from a provincial word which in their language signified *martial* or *warlike*. The Mamertines were afterwards defeated by Hiero, and totally disabled to repair their ruined affairs.

MAMMÆ, in anatomy. See there, n° 112.

MAMMALIA, in natural history, the first class of animals in the Linnean system, divided into seven orders. See ZOOLOGY.

MAMMEA, *MAMMEE-Tree*: A genus of the monogynia order, belonging to the polyandria class of plants; and in the natural method ranking with those of which the order is doubtful. The corolla is tetrapetalous; the calyx diphyllous; the berry very large and tetraspermous. There are two species; both of them large evergreen trees of the hot parts of America and Asia, and retained here in hot-houses for variety; both of them adorned with large, oval, oblong, stiff leaves, and large quadrupetalous flowers, succeeded by large round eatable fruit of a most exquisitely rich flavour. They are propagated by seed, which is to be sowed in small pots of light earth, and plunged in the bark-bed, where they will soon come up; give gentle waterings, and about August transplant them into separate pots a size larger, plunging them into the bark-bed, and giving shade and water till fresh-rooted. In this country they must never be taken out of the stove.

MAMMON, the god of riches, according to some authors; though others deny that the word stands for such a deity, and understand by it only *riches* themselves. Our Saviour says, *We cannot serve God and mammon*; that is, be religious and worldly-minded at the same time. Our poet Milton, by poetic licence, makes Mammon to be one of the fallen angels, and gives us his character in the following lines:

Mammon, the least erected spirit that fell
From heav'n: for ev'n in heav'n his looks and thoughts
Were always downward bent; admiring more
The riches of heav'n's pavement, trodden gold,
Than ought divine or holy eith enjoy'd
In heav'n's vision: by him first
Man also, and by his suggestion taught,
Rais'd back'd the centre, and with impious hands
Rifled the bowels of their mother earth,
For treasures better hid. Soon had his crew
Open'd into the hill a spacious wound,
And digg'd out ribs of gold. Let none admire
That riches grow in hell; that soil may best
Deserve the precious bane.

MAMMOTH, or MAMMUTH, the name of a huge *Mammoth*. animal now unknown, to which are said to have belonged those tusks, bones, and skeletons of vast magnitude, which have been frequently found in different parts of Siberia, as well in the mountains as the valleys; likewise in Russia, Germany, and North America. Many specimens of them may be seen in the Imperial cabinet at Peterburgh; in the British, Dr Hunter's, and the late Sir Ashton Lever's museums, and in that of the Royal Society. A description of the mammoth is given by Muller in the *Recueil des Voyages au Nord*. "This animal, he says, is four or five yards high, and about 30 feet long. His colour is greyish. His head is very long, and his front very broad. On each side, precisely under the eyes, there are two horns, which he can move and cross at pleasure. In walking he has the power of extending and contracting his body to a great degree." Ibrandes Ides gives a similar account; but he is candid enough to acknowledge, that he never knew any person who had seen the mammoth alive. Mr Pennant, however, thinks it "more than probable, that it still exists in some of those remote parts of the vast new continent, impenetrated yet by Europeans. Providence (he adds) maintains and continues every created species; and we have as much assurance, that no race of animals will any more cease while the earth remaineth, than *seed-time and harvest, cold and heat, summer and winter, day and night*." The Ohio Indians have a tradition handed down from their fathers respecting these animals, "That in ancient times a herd of them came to the Big-bone Licks, and began an universal destruction of the bears, deer, elks, buffaloes, and other animals which had been created for the use of the Indians: that the Great Man above, looking down and seeing this, was so enraged that he seized his lightning, descended to the earth, seated himself upon a neighbouring mountain on a rock, on which his feat and the print of his feet are still to be seen, and hurled his bolts among them till the whole were slaughtered, except the big bull, who presenting his forehead to the shafts, shook them off as they fell; but at length missing one, it wounded him in the side; whereon, springing round, he bounded over the Ohio, the Wabash, the Illinois, and finally over the great lakes, where he is living at this day."

Several eminent naturalists, as Sir Hans Sloane, Gmelin, Daubenton, and Buffon, are of opinion that these prodigious bones and tusks are really the bones and tusks of elephants, and many modern philosophers have held the mammoth to be as fabulous as the centaur. The great difference in size they endeavour to account for as arising from difference in age, sex, and climate; and the cause of their being found in those northern parts of the world where elephants are no longer natives, nor can even long exist, they presume to have arisen from hence; that, in the great revolutions which have happened in the earth, the elephants, to avoid destruction, have left their native country, and dispersed themselves wherever they could find safety. Their lot has been different. Some in a longer and others in a shorter time after their death, have been transported to great distances by some vast inundations. Those, on the contrary, which survived, and wandered far to the north, must necessarily have

Mammoth, fallen victims to the rigour of the climate. Others, without reaching to so great a distance, might be drowned, or perish with fatigue. In the year 1767, Dr Hunter, with the assistance of his brother Mr J. Hunter, had an opportunity of investigating more particularly this part of natural history, and has evidently proved, that these fossil bones and tusks are not only larger than the generality of elephants, but that the tusks are more twisted, or have more of the spiral curve, than elephants teeth; and that the thigh and jaw bones differ in several respects from those of the elephant: but what put the matter beyond all dispute was the shape of the grinders, which clearly appeared to belong to a carnivorous animal, or at least to an animal of the mixed kind; and to be totally different from those of the elephant, which is well known not to be of the carnivorous, but graminivorous kind, both by the form of its grinders and by its never tasting animal food.—Some have supposed these fossil bones to belong to the hippopotamus or river-horse; but there are many reasons against this supposition, as the hippopotamus is even much smaller than the elephant, and has such remarkably short legs, that his belly reaches within three or four inches of the ground.

North America seems to be the quarter where the remains in question most abound. On the Ohio, and in many parts farther north, tusks, grinders, and skeletons of unparalleled magnitude, which can admit of no comparison with any animal at present known, are found in vast numbers, some lying on the surface of the earth, and some a little below it. A Mr Stanley, taken prisoner by the Indians near the mouth of the Tanissee, relates, as Mr Jefferson† informs us, that after being transferred through several tribes, from one to another, he was at length carried over the mountains west of the Missouri to a river which runs westwardly; that these bones abounded there; and that the natives described to him the animal to which they belonged as still existing in the northern parts of their country; from which description he judged it to be an elephant. Bones of the same kind have been lately found some feet below the surface of the earth, in salines opened on the North Holston, a branch of the Tanissee, about the latitude of 36½° N. Instances are mentioned of like animal remains found in the more southern climates of both hemispheres: but Mr Jefferson observes, “they are either so loosely mentioned, as to leave a doubt of the fact; so inaccurately described, as not to authorize the classing them with the great northern bones; or so rare, as to found a suspicion that they have been carried thither as curiosities from more northern regions. So that, on the whole, there seem to be no certain vestiges of the existence of this animal farther south than the salines last mentioned. It is remarkable (continues he) that the tusks and skeletons have been ascribed by the naturalists of Europe to the elephant, while the grinders have been given to the hippopotamus or river-horse. Yet it is acknowledged, that the tusks and skeletons are much larger than those of the elephant, and the grinders many times greater than those of the hippopotamus, and essentially different in form. Wherever these grinders are found, there also we find the tusks and skeleton; but no skeleton of the hippopotamus nor grinders of

the elephant. It will not be said that the hippopotamus and elephant came always to the same spot, the former to deposit his grinders, and the latter his tusks and skeleton. For what became of the parts not deposited there? We must agree, then, that these remains belong to each other; that they are of one and the same animal; that this was not a hippopotamus, because the hippopotamus had no tusks nor such a frame, and because the grinders differ in their size as well as in the number and form of their points. That it was not an elephant, I think ascertained by proofs equally decisive. I will not avail myself of the authority of the celebrated anatomist*, who, from an examination of the form and structure of the tusks, has declared they were essentially different from those of the elephant; because another anatomist†, equally celebrated, has declared, on a like examination, that they are precisely the same. Between two such authorities I will suppose this circumstance equivocal. But, 1. The skeleton of the mammoth (for so the incognitum has been called) bespeaks an animal of five or six times the cubic volume of the elephant, as M. de Buffon has admitted. 2. The grinders are five times as large, are square, and the grinding surface fluted with four or five rows of blunt points: whereas those of the elephant are broad and thin, and their grinding surface flat. 3. I have never heard an instance, and suppose there has been none, of the grinder of an elephant being found in America. 4. From the known temperature and constitution of the elephant, he could never have existed in those regions where the remains of the mammoth have been found. The elephant is a native only of the torrid zone and its vicinities: if, with the assistance of warm apartments and warm clothing, he has been preserved in life in the temperate climates of Europe, it has only been for a small portion of what would have been his natural period, and no instance of his multiplication in them has ever been known. But no bones of the mammoth, as I have before observed, have been ever found further south than the salines of the Holston, and they have been found as far north as the Arctic circle. Those, therefore, who are of opinion that the elephant and mammoth are the same, must believe, 1. That the elephant known to us can exist and multiply in the frozen zone; or, 2. That an internal fire may once have warmed those regions, and since abandoned them, of which, however, the globe exhibits no unequivocal indications; or, 3. That the obliquity of the ecliptic, when these elephants lived, was so great as to include within the tropics all those regions in which the bones are found; the tropics being, as is before observed, the natural limits of habitation for the elephant. But if it be admitted that this obliquity has really decreased, and we adopt the highest rate of decrease yet pretended, that is, of one minute in a century, to transfer the northern tropic to the Arctic circle, would carry the existence of these supposed elephants 250,000 years back; a period far beyond our conception of the duration of animal bones left exposed to the open air, as these are in many instances. Besides, though these regions would then be supposed within the tropics, yet their winters would have been too severe for the sensibility of the elephant. They would have had, too, but one day and one night

† *Notes on the State of Virginia*, p. 65.

* Hunter.
† D'Aubenton.

Mammoth
Mamre.

Man.

in the year; a circumstance to which we have no reason to suppose the nature of the elephant fitted. However, it has been demonstrated, that if a variation of obliquity in the ecliptic takes place at all, it is vibratory, and never exceeds the limits of nine degrees, which is not sufficient to bring these bones within the tropics. One of these hypotheses, or some other equally arbitrary and inadmissible to cautious philosophy, must be adopted to support the opinion that these are the bones of the elephant. For my own part, I find it easier to believe that an animal may have existed, resembling the elephant in his tusks and general anatomy, while his nature was in other respects extremely different. From the 35th degree of south latitude to the 30th of north, are nearly the limits which nature has fixed for the existence and multiplication of the elephant known to us. Proceeding thence northwardly to 36½ degrees, we enter those assigned to the mammoth. The further we advance north, the more their vestiges multiply as far as the earth has been explored in that direction; and it is as probable as otherwise, that this progression continues to the pole itself, if land extends so far. The centre of the frozen zone then may be the acme of their vigour, as that of the torrid is of the elephant. Thus nature seems to have drawn a belt of separation between these two tremendous animals, whose breadth indeed is not precisely known, though at present we may suppose it about 6½ degrees of latitude; to have assigned to the elephant the regions south of these confines, and those north to the mammoth, founding the constitution of the one in her extreme of heat, and that of the other in the extreme of cold. When the Creator has therefore separated their nature as far as the extent of the scale of animal life allowed to this planet would permit, it seems perverse to declare it the same, from a partial resemblance of their tusks and bones. But to whatever animal we ascribe these remains, it is certain such a one has existed in America, and that it was the largest of all terrestrial beings of which any traces have ever appeared."

MAMRE, an Amorite, brother of Auer and Eschol, and friend of Abraham (Gen. xiv. 13.). It was with these three persons, together with his own and their domestics, that Abraham pursued and overcame the kings after their conquest of Sodom and Gomorrah. This Mamre, who dwelt near Hebron, communicated his name to great part of the country round about. Hence we read (ch. xiii. 18. xxiii. 17, &c.), that Abraham dwelt in Mamre and in the plain of Mamre. But it is observed, that what we translate the *plain* should be rendered the *oak*, of Mamre, because the word

elon signifies an *oak* or *tree of a long duration*. Sozomen tells us, that this tree was still extant, and famous for pilgrimages and annual feasts, even in Constantine's time; that it was about six miles distant from Hebron; that some of the cottages which Abraham built were still standing near it; and that there was a well likewise of his digging, whereunto both Jews, Christians, and Heathens, did at certain seasons resort, either out of devotion or for trade, because there was held a great mart. To these superstitious Constantine the Great put a stop.

MAN, the head of the animal creation, is a being who feels, reflects, thinks, contrives, and acts; and has the power of changing his place upon the earth at pleasure; who possesses the faculty of communicating his thoughts by means of speech; and who has dominion over all other creatures on the face of the globe. Animated and enlightened by a ray from the Divinity, he surpasses in dignity every material being. He spends less of his time in solitude, than in society and in obedience to those laws which he himself has framed.

In the *Systema Nature*, MAN (*Homo*) is ranked as a distinct genus of the order *Primates* or "Chiefs," belonging to the *Mammalia* class of animals, or those which nourish their young by means of lactiferous teats or paps. Of this genus he is the only species (A); and denominated *Sapiens*, as being endowed with wisdom far superior to, or rather in exclusion of, all other animals—He varies, from climate, education, and habits; and the following varieties, exclusive of *Varieties of wild men* (B), are enumerated by Linnaeus.

a Americans. "Of copper-coloured complexion, choleric constitution, and remarkably erect."—Their hair is black, lank, and coarse; their nostrils are wide; their features harsh, and the chin is scantily supplied with beard. Are obdurate in their tempers, free and satisfied with their condition; and are regulated in all their proceedings by traditional customs.—Paint their skin with red streaks.

b Europeans. "Of fair complexion, sanguine temperament, and brawny form."—The hair is flowing, and of various shades of brown; the eyes are mostly blue.—They are of gentle manners, acute in judgment, of quick invention, and governed by fixed laws.—Dress in close vestments.

γ Asiatics. "Of sooty complexion, melancholic temperament, and rigid fibre."—The hair is strong, black, and lank; the eyes are dark brown.—They are of grave, haughty, and covetous manners; and are governed by opinions.—Dress in loose garments.

δ Africans. "Of black complexion, phlegmatic

3 S 2

tempe-

(A) In the early editions of Linnaeus, the *Troglodytes* was added as another species; but is now more properly ranked under the genus *Simia*. See *SIMIA*.

(B) *HOMINES Feri*; described as walking on all-fours, as being dumb, and as covered with hair.—1. A youth found in Lithuania, in 1761, resembling a bear. 2. A youth found in Hesse, in 1544, resembling a wolf. 3. A youth in Ireland resembling a sheep, (*Tulp. Obs. iv. 9.*) 4. A youth in Bamberg resembling an ox, (*Camerarius.*) 5. A wild youth found in 1724 in Hanover. 6. Wild boys found in 1719 in the Pyrenees. 7. A wild girl found in 1717 in Overysel. 8. A wild girl found in 1731 in Champagne. 9. A wild lad found near Leyden, (*Bierbaume.*)—These instances of wild men and their similitudes, according to Mr Kerr's, are partly to be attributed to imposture, and in part to exaggeration: Most probably (he thinks) idiots who had strayed from their friends, and who resembled the above animals only in imitating their voices.

Translation
of the *Animal
kingdom* of
Linnaeus,
p. 44. note.

Man. temperament, and relaxed fibre."—The hair is black and frizzly; the skin soft and silky; the nose flat; the lips are thick; and the female has a natural apron \dagger , and long lax breasts.—They are of crafty, indolent, and careless dispositions, and governed in their actions by caprice.—Anoint the skin with grease.

\dagger A doubtful circumstance.

1. *Montfiers*. Of these there are several varieties; the first and second of which, in the following list, are occasioned by peculiarity of climate, while the rest are produced by artificial management. 1. *Alpini*; The inhabitants of the northern mountains: they are small in stature, active and timid in their dispositions. 2. *Patagoniæ*: The Patagonians of South America; of vast size, and indolent in their manners. 3. *Monorchides*: The Hottentots; having one testicle extirpated. 4. *Imberbes*: Most of the American nations; who eradicate their beards and the hair from every part of the body except the scalp. 5. *Macrocephali*: The Chinese; who have their heads artificially forced into a conical form. 6. *Plagiocephali*: The Canadian Indians; who have the fore part of their heads flattened, when young, by compression.

3. Gmelin's arrangement, (not in loc. ubi supra.) The following arrangement of the varieties in the human species, is offered by Dr Gmelin as more convenient than that of Linnaeus.

1. White, a: (*Hom. Albus*.) Formed by the rules of symmetrical elegance and beauty; or at least what we consider as such.—This division includes almost all the inhabitants of Europe; those of Asia on this side of the Ob, the Caspian, Mount Imaus, and the Ganges; likewise the natives of the north of Africa, of Greenland, and the Esquimaux.

b, Brown: (*Hom. Badius*.) Of a yellowish brown colour; has scanty hairs, flat features, and small eyes.—This variety takes in the whole inhabitants of Asia not included in the preceding division.

c. Black: (*Hom. Niger*.) Of black complexion; has frizzly hair, a flat nose, and thick lips.—The whole inhabitants of Africa, excepting those of its more northern parts.

d, Copper-coloured: (*Hom. Cupreus*.) The complexion of the skin resembles the colour of copper not burnished.—The whole inhabitants of America, except the Greenlanders and Esquimaux.

e, Tawny: (*Hom. Fuscus*.) Chiefly of a dark blackish-brown colour; having a broad nose, and harsh coarse straight hair.—The inhabitants of the southern islands, and of most of the Indian islands.

The following is Linnaeus's description of *Man*, as translated by Mr Kerr.

4. Zoological description of man. "The Body, which seldom reaches six feet in height, is erect, and almost naked, having only some scattered distant hairs, except in some small spots to be afterwards noticed, and when first born is entirely naked. The Head is shaped like an egg; the scalp being long, and covered with hair; the forehead broad; the top of the head flat; and the hind-head protuberant. The Face is naked, having the brow or forehead flattened and quadrangular; the temples are compressed, with peaked angles pointing upwards and backwards towards the hairy scalp. The eye-brows are prominent, and covered with hairs which, shedding outwards, cover each other like tiles; and between the inner extremities of the two eye-brows, there is a smooth, shallow furrow or depression, in a

line with the nose. The upper eye-lid is moveable, but the lower one hardly moves, and both are planted at their edges with a row of stiff recurved hairs, named *eye-lashes*. The eye-balls are round, having no suspending muscle as in those of most quadrupeds; the pupil, or opening of the sight, is circular; and the eye has no *membrana nictitans*. The upper parts of the cheeks are prominent, softish, and coloured with a red bluish; their outer parts flattened; the lower parts are hollowed, lax, and expansile. The nose is prominent, and compressed at the sides; its extremity or point is higher than the rest, and blunt; the nostrils are oval, open downwards, with thickened edges, and are hairy on their insides. The upper lip is almost perpendicular, and is furrowed on the middle, from the division between the nostrils to the edge of the lip; the under lip is erect, thicker and more prominent than that above; both have a smooth red protuberance, surrounding the mouth at their edges. The chin is prominent, blunt, and gibbous. In males, the face all round the mouth is covered with hair, called the *beard*, which first appears about puberty, in patches on the chin. The teeth in both jaws may be distinguished into three orders; the *fore-teeth* are erect, parallel, and wedge-like, of the kind named *incisors*, or *cutting-teeth*; they stand close to each other, and are more equal and rounder than in other animals; the *tufts*, called in man *eye-teeth* and *corner-teeth*, of which there is only one on each side of the fore-teeth in each jaw, are a little longer than the fore-teeth, but much less so than in other animals, and they are placed close to the other teeth; the *grinders*, of which there are five on each side in both jaws, are blunt, and divided on their upper surface into pointed eminences; but these are not so remarkable as in other animals. The ears are placed on the sides of the head, are of an oblong rounded figure, with a femilunar bend on their anterior edges; they lie flat to the head, are naked, arched at the margin on their upper and posterior edges, and are thicker and softer at the under extremities.

"The Trunk of the body consists of the neck, breast, back, and belly. The Neck is roundish, and shorter than the head; its vertebrae, or chine bones, are not, as in most animals, connected by a suspensory ligament; the nape is hollowed; the throat, immediately below the chin, is hollowed at its upper part, and protuberant in the middle a little lower down. The Breast is somewhat flattened both before and behind; on the fore-part there is a cavity or depression where it joins with the neck; the arm-pits are hollow and hairy; the pit of the stomach is flat: On the breast are two distant, round, protuberant mammae, or dugs, each having a cylindrical obtuse wrinkled projecting nipple, which is surrounded by a darker coloured circle called the *areola*. The Back is flat, having protuberances on each side at the shoulder-blades, with a furrow or depression between them. The Abdomen or belly is large and protuberant, with a hollow at the navel; the epigastric region, or situation of the stomach, is flat; the hypogastric regions, or sides of the belly, are protuberant; the groins flatish and hollowed. The pubes is hairy; the pelvis, or basin, is wider above, and grows narrower below. The male parts are external and loose; the penis cylindrical; the scrotum

Man.

ferotum roundish, lax, and wrinkled, being divided in the middle by a longitudinal ridge or smooth line, which extends along the whole perineum: The female parts are compressed and protuberant, having labia, nymphæ, clytoris, and hymen; and, in adults, secreting the catamenia. There is no external tail.

"The Limbs consist of arms and hands instead of fore-legs; and of thighs, legs, and feet. The Arms are placed at a distance from each other; they are round, and about a foot in length from the joint of the shoulder to the elbow; the fore-arm, or cubit, contains two bones, and is obtusely prominent; the *ulna*, which forms the principal thickness of the member, is round, and somewhat flattened on the inside. The Hands are broad, flat, and rounded; convex on the outside or back of the hand, and concave on the inside or palm. Each hand has five fingers, one of which, named the *thumb*, is shorter and thicker than the rest, and is placed at some distance from them; the others are near each other, and placed parallel, the outer or *little-finger* being the smallest; the second, named *index* or *fore-finger*, and the fourth, called the *ring-finger*, are next in length and in size; and the third, or *middle-finger*, is the longest; the point of this last, when the arm and hand hang down, reaches to the middle of the thigh. The nails are rounded and oval, being flatly arched, or convex upwards, and each has a femineal whitish mark at the root or lower extremity.

"The lower limbs are placed close together, having brawny muscular haunches and swelling fleshy hips; the knees are obtuse, bend forwards, and have hollow hams behind. The Legs, which are nearly of the same length with the thighs, are of a muscular make behind, where they swell out into what is called the *calf*; they are lean, and free of flesh on the thins or fore-parts, and taper downwards to the ankle, which have hard hemispherical projections on each side, named the *ankle-bones* or *malleole*. The heel is thick, prominent, and gibbous, being longer and broader than in other animals, for giving a firm support to the body; it joins immediately with the sole of the foot. The Feet are oblong, convex above, and flattened on the soles, which have a transverse hollow about the middle. Each foot has five toes, somewhat bent downwards, and gibbous or swelled underneath at their extremities; they are all placed close together, the inner or great-toe being thicker and somewhat shorter than the rest; the second and third are nearly of equal length; and the fourth and fifth are shorter than the others, the last mentioned or little toe being the shortest and smallest. The toe nails resemble those on the fingers, which are already described.

"Thus man differs from the other animals in his erect posture and naked skin, having a hairy scalp, being furnished with hair on the eye-brows and eyelashes, and having, when arrived at puberty, the pubes, breast, arm-pits, and the chin of the males, covered with hair. His brain is larger than that of any other animal, even the most enormous; he is provided with an *uvula*, and has organs of speech. His face is placed in the same parallel line with his body; he has a projecting compressed nose, and a prominent chin. His feet in walking rest on the heel. He has no tail; and, lastly, the species is distinguished from other animals

by some peculiarities of the female constitution, which have been already mentioned."

Nosce Teipsum, "Know thyself," is a precept worthy of the lawgiver of Athens: it has been called the first step to wisdom, and was formerly written on letters of gold in the temple of Diana. In the pursuit of this important branch of knowledge, Man may be contemplated in the seven following respects:

1. **PHYSIOLOGICALLY**,—as a frail machine, chiefly composed of nerves and fibres interwoven with each other. His most perfect state is during youth; and he is endowed with faculties more numerous, and in higher perfection, than those of all other animals. "Man, intended for exercising dominion over the whole animal creation, is sent by Nature into the world naked, forlorn, and bewailing his lot; he is then unable to use his hands or feet, and is incapable of acquiring any kind of knowledge without instruction; he can neither speak, nor walk, nor eat, nor perform any action whatever by natural instinct:" *Pliny*.—"We may judge what kind of life is allotted to us by Nature, since it is ordained, as an omen, that we should come weeping into the world:" *Seneca*.—"It is humiliating to the pride of man, to consider the pitiable origin of this most arrogant of all the animals:" *Pliny*.

2. **DIETETICALLY**,—*Cura valitudinem*. Bodily health and tranquillity of mind are more to be desired than all the riches, pomp, or glory, of a Cræsus, a Solomon, or an Alexander. Health is to be preserved by moderation, it is destroyed by abstinence, injured by variety of delicacies, weakened by unusual things, and strengthened by the use of proper and accustomèd fare. Man, learned in the pernicious art of cookery, is fond of many dishes, rendered palatable by the injurious effects of fire, and by the baneful addition of wine. "Hunger is satisfied with a small quantity of food, luxury demands overabundance. Imagination requires vast supplies; while nature is contented with a moderate quantity of ordinary food, and is burthened by superfluity:" *Seneca*.—"According as thou livest, so shall thy life be enjoyed."

3. **PATHOLOGICALLY**,—*Memento mori*! The life of man resembles a bubble ready to burst; his fate is suspended by a hair, and is dependent on the uncertain lapse of time. "The earth contains nothing more frail than man:" *Homer*.—"Nothing is weaker than human life: To what dangers, and to how many diseases, is it not exposed? Hence the whole period of a man's life is but a span: Half of it is necessarily spent in a state resembling death; without including the years of infancy, wherein there is no judgment; or the period of old age, fertile in sufferings, during which the senses are blunted, the limbs become stiff, and the faculties of sight and hearing, the powers of walking, and the teeth, the instruments of nourishment, fail before the rest of the body:" *Pliny*.—"Thus a considerable part of death is suffered during life; and death possesses all that belonged to the times which are past. Finally, nature will speedily recall and destroy all the beings which thou feest, and all that thy imagination can suppose to exist hereafter; for death calls equally upon all, whether they be good or whether they be evil:" *Seneca*, ii. 59.

4. **NATURALLY**,—*Innocui vivite, Numen adest!* Man, the prince of animated beings, who is a miracle of nature,

Self-know-
ledge, or
the study of
man. (*Syst.*
Nat. Kerr.)

Man.

ture, and for whom all things on this earth were created, is a mimic animal, weeping, laughing, singing, speaking; tractable, judicious, inquisitive, and most wife; he is weak and naked, unprovided with natural weapons, exposed to all the injuries of fortune, needful of assistance from others, of an anxious mind, solicitous of protection, continually complaining, changeable in temper, obdurate in hope, and slow in the acquisition of wisdom. He despises the time which is past, abuses that which is present, and sets his affections on the uncertain future; thus continually neglecting winged time, which, though infinitely precious, can never be recalled: For thus the best and readiest time, in every age, flies on with miserable mortals; some it summons to attend their daily and burthenome labours; some it confines to luxurious inaction, pampered even to suffocation with superfluities; some it solicits in the ever restless paths of ambition; some it renders anxious for the acquisition of wealth, and distrusts for the possession of the thing desired; some it condemns to solitude, and others to have their doors continually crouded with visitors; here one bewails the conduct of his children, there one grieves their loss. Tears will sooner fail us than their causes, which only oblivion can remove. "On every hand our evils overbalance our advantages; we are surrounded with dangers; we rush forwards into untried situations; we are enraged without having received provocation; like wild beasts, we destroy those we do not hate; we wish for favourable gales, which lead us only to destruction; the earth yawns wide, ready for our death." *Seneca*.—"Other animals unite together against enemies of a kind different from their own, while man suffers most injuries from his own species." *Pliny*.

5. POLITICALLY.—*Esse antiqua virtute et fide!* Man, instead of following that which is right, is subjected to the guidance of manifest error; this envelops all his faculties under the thick veil of custom, as soon as he is born; according to its dictates he is fed, educated, brought up, and directed, in all things; and by its arbitrary rules his honesty, fortitude, wisdom, morality, and religion, are judged of; thus, governed by opinion, he lives conformably to custom, instead of being guided by reason. Though sent into the world a perishable being, for all are evidently born to suffer, instead of endeavouring to secure those things which are most advantageous and truly beneficial, he, insatuated by the smiles of fortune, anxiously collects her gaudy trifles for future enjoyment, and neglects her real benefits; he is driven to madness by envious snarlers; he persecutes with hatred the truly religious for differing from himself in speculative opinions; he excites numberless broils, not that he may do good, but for a purpose that even himself is ignorant of. He wastes his precious and irrecoverable time in trifles; he thinks lightly of immortal and eternal concerns, while regulating the succession of his posterity; and perpetually entering on new projects, forgetful of his real condition, he builds palaces instead of preparing his grave; till at length, in the midst of his schemes, death seizes him; and then, first opening his eyes, he perceives, O man! that all is delusion. "Thus we live as if immortal, and first learn in death that we have to die." *Seneca*.

Man.

6. MORALLY.—*Bene fac et late!* Man is composed of an animated medullary substance, which prompts him to that which is right; and of a bodily frame liable to impressions, which incites him to the enjoyment of pleasure. In his natural state he is foolish, wanton, an inconsiderate follower of example, ambitious, profuse, dissatisfied, cunning, peevish, invidious, malicious, and covetous; by the influence of just morals he is transformed to be attentive, chaste, considerate, modest, temperate, quiet, sincere, mild, beneficent, grateful, and contented. "Sorrow, luxury, ambition, avarice, the desire of life, and anxiety for the future, are common to all animals." *Pliny*.

7. THEOLOGICALLY.—*Memento Creatoris tui!* Man, the ultimate purpose of creation, and masterpiece of the works of Omnipotence, was placed on earth that he might contemplate its perfections; he was endowed with sapient reason, and made capable of forming conclusions from the impressions of his senses, that, from a consideration of created objects, he might know their Creator as the Almighty, the Infinite, the Omniscient, the Eternal God: That we may live morally under his governing care, it is requisite that we have a thorough conviction of its existence, and must have it ever in remembrance. Other revealed matters on this subject are left to be explained by the theologians.

"There are two things which lead to a knowledge of God; creation and revelation." *Augustine*.—"God, therefore, may be found out by the light of nature, but is only to be known by the assistance of doctrine." *Tertullian*.—"Man alone has the inestimable privilege of contemplating the perfections of God, who is the author both of nature and of revelation." *Ibid*.—"Learn that God has both ordered you to exist, and that you should study to act that part properly which is allotted for you in life." *Perf. Sat.* iii. 71.

The whole of this ENCYCLOPEDIA may in some respect be accounted an analysis of MAN; as comprehending his knowledge of God, of himself, and of natural and artificial objects. In the sequel of this article we shall collect into one view the most important particulars relating to himself individually, considered as a physical being, and as forming a subject of natural history.

Anatomists have employed much pains in the study of the material part of man, and of that organization which determines his place in the animal creation. From tracing and combining his different external parts; from observing that his body is in some places covered with hair; that he can walk upon his hands and his feet at the same time, in the manner of quadrupeds; that, like certain animals which hold their food in their paws, he has two clavicles; that the female brings forth her young alive, and that her breasts are supplied with milk: from these circumstances we might be led to assign man a place in the class of viviparous quadrupeds. But, in our opinion, such an arrangement would be defective, arbitrary, and absurd. Man is not a quadruped: Of all the animals, he alone can support himself, continually and without restraint, in an erect posture (that is, with his head and body in a vertical line upon his legs). In this majestic and dignified attitude, he can change his place, survey this earth which he inhabits, and turn his eyes towards the vault of heaven. By a noble and easy gait, he preserves

6
Natural history of Man.

† See Com-
parative An-
atomy,
Sect. i. ii.

preserves an equilibrium in the several parts of his body, and transports himself from one place to another with different degrees of celerity (c). To man alone na-

ture has denied a covering; but still he is her masterpiece, the last work which came from the hands of the Almighty Artificer, the sovereign and the chief of animals,

(c) M. Daubenton, after a careful examination of those characters in the form of man by which he is distinguished from other animals, has reduced them to two heads. The first is the strength of the muscles of the legs, by which the body is supported in a vertical position above them; the second consists in the articulation of the head with the neck by the middle of its base.

We stand upright, bend our body, and walk, without thinking on the power by which we are supported in these several positions. This power, says M. Daubenton, resides chiefly in the muscles, which constitute the principal part of the calf of the leg. Their exertion is felt, and their motion is visible externally when we stand upright and bend our body backwards and forwards. This power is no less great when we walk even on an horizontal plane. In ascending a height, the weight of the body is more sensibly felt than in descending. All these motions are natural to man. Other animals, on the contrary, when placed on their hind legs, are either incapable of performing them at all, or do it partially, with great difficulty, and for a very short time. The *gibbon*, and the *jocko* or *ourang-outang*, are the animals most resembling man in their construction: they can stand upright with much less difficulty than other brutes; but the restraint they are under in this attitude plainly shows that it is not natural to them. The reason is, that the muscles in the back part of the leg in the gibbon and the jocko are not, as in man, sufficiently large to form a calf, and consequently not sufficiently strong to support the thighs and body in a vertical line, and to preserve them in that posture.

M. Daubenton has discovered, that the attitudes proper to man and to the animals are pointed out by the different manners in which the head is articulated with the neck. The two points, by which the officious part of the head is connected with the first vertebra of the neck, and on which every movement of the head is made with the greatest facility, are placed at the edge of the great foramen of the occipital bone, which in man is situated near the centre of the base of the cranium, affords a passage for the medullary substance into the vertebrae, and determines the place of the articulation of the head with the neck. The body and neck being, according to the natural attitude, in a vertical direction, the head must be placed in equilibrium upon the vertebrae as upon a pivot or point of support. The face is on a vertical line, almost parallel to that of the body and neck. The jaws, which are very short compared with those of most other animals, extend very little farther forwards than the forehead.

No animal has, like man, its hind legs as long as the body, neck, and head, taken together, measuring from the top of the head to the os pubis.

In the frame of the human body the principal parts are nearly the same with those of other animals; but in the connection and form of the bones, says M. Daubenton, there is as great a difference as in the attitudes proper to each. Were a man to assume the natural posture of quadrupeds, and try to walk by the help of his hands and feet, he would find himself in a very unnatural situation; he could not move his feet and head but with the greatest difficulty and pain; and let him make what exertions he pleased, he would find it impossible to attain a steady and continued pace. The principal obstacles he would meet with would arise from the structure of the pelvis, the hands, the feet, and the head.

The plane of the great occipital foramen, which in man is almost horizontal, puts the head in a kind of equilibrium upon the neck when we stand erect in our natural attitude: but when we are in the attitude of quadrupeds, it prevents us from raising our head so as to look forwards, because the movement of the head is stopped by the protuberance of the occiput, which then approaches too near the vertebrae of the neck.

In most animals, the foramen magnum of the occipital bone is situated at the back part of the head; the jaws are very long; the occiput has no protuberance beyond the aperture, the plane of which is in a vertical direction, or inclined a little forwards or backwards; so that the head is pendant, and joined to the neck by its posterior part. This position of the head enables quadrupeds, though their bodies are in a horizontal direction, to prevent their muzzle forwards, and to raise it so as to reach above them, or to touch the earth with the extremity of their jaws when they bring their neck and head down to their feet. In the attitude of quadrupeds, man could touch the earth only with the fore part or the top of the head.

To these differences of structure, M. Daubenton adds, that when man is standing, his heel rests upon the earth as well as the other parts of his foot; when he walks it is the first part which touches the ground; man can stand on one foot: these are peculiarities in structure and in the manner of moving which are not to be found in other animals. We may therefore conclude that man cannot be ranked in the class of quadrupeds. We may add, that in man the brain is much larger, and the jaws much shorter, than in any other animal. The brain, by its great extent, forms the protuberance of the occipital bone, the forehead, and all that part of the head which is above the ears. In animals, the brain is so small, that most of them have no occiput, or the front is either wanting or little raised. In animals which have large foreheads, such as the horse, the ox, the elephant, &c. they are placed as low, and even lower, than the ears. These animals likewise want the occiput, and the top of the head is of very small extent. The jaws, which form the greatest portion of the muzzle, are large in proportion to the smallness of the brain. The length of the muzzle varies in different animals: in folioped animals it is very long; it is short in the *ourang-outang*; and in man it does not exist at all. No beard grows on the muzzle: this part is wanting in every animal.

Man.

man, a world in miniature, the centre which connects the universe together. The form of his body, the organs whereof are constructed in such a manner as to produce a much greater effect than those of other animals, announces his power. Every thing demonstrates the excellence of his nature, and the immense distance placed by the bounty of the Creator between man and beast. Man is a reasonable being; brute animals are deprived of that noble faculty. The weakest and most stupid of the human race is able to manage the most sagacious quadruped; he commands it, and makes it subservient to his use. The operations of brutes are purely the effect of mechanical impulse, and continue always the same; human works are varied without end, and infinitely diversified in the manner of execution. The soul of man is free, independent, and immortal. He is fitted for the study of science, and the cultivation of art; he has the exclusive privilege of examining every thing which has existence, and of holding communication with his fellow-creatures by language, by particular motions of the body, and by marks and characters mutually agreed upon. Hence arises that physical pre-eminence which he enjoys over all animals; and hence that power which he possesses over the elements, and (so to speak) over nature itself. Man, therefore, is unequalled in his kind; but the individuals thereof differ greatly from one another in figure, stature, colour, manners, and dispositions. The globe which man inhabits is covered with the productions of his industry and the works of his hands: it is his labour, in short, which gives a value to the whole terrestrial mass.

The history of man is an object of attention highly interesting, whether we consider him in the different periods of his life, or take a view of the varieties of the species, or examine the wonderful organization of his frame. We shall, therefore, attempt to give a short sketch of him in these different points of view; referring occasionally to other parts of the work for more particular details.

7
Different
periods of
man's life.

"Nothing (says M. Buffon) exhibits such a striking picture of our weakness, as the condition of an infant immediately after birth. Incapable of employing its organs, it needs assistance of every kind. In the first moments of our existence, we present an image of pain and misery, and are more weak and helpless than the young of any other animal. At birth, the infant passes from one element to another: When it leaves the gentle warmth of the tranquil fluid by which it was completely surrounded in the womb of the mother, it becomes exposed to the impressions of the air, and instantly feels the effects of that active element. The air acting upon the olfactory nerves, and upon the organs of respiration, produces a shock something like freezing, by which the breast is expanded, and the air admitted into the lungs. In the mean time, the agitation of the diaphragm presses upon the viscera of the abdomen, and the excrements are thus for the first time discharged from the intestines, and the urine from the bladder. The air dilates the vessels of the lungs, and after being rarefied to a certain degree, is expelled by the spring of the dilated fibres reacting upon this rarefied fluid. The infant now respire; and articulates sounds, or cries. [For the condition of the *fetus in utero*

N° 193.

Mat.

ro, where it lives without respiration, see ANATOMY, n° 110; and for the nature and importance of respiration, see n° 118.]

Most animals are blind for some days after birth. Infants open their eyes to the light the moment they come into the world; but they are dull, fixed, and commonly blue. The new-born child cannot distinguish objects, because he is incapable of fixing his eyes upon them. The organ of vision is yet imperfect; the cornea is wrinkled; and perhaps the retina is too soft for receiving the images of external objects, and for communicating the sensation of distinct vision. At the end of forty days, the infant begins to hear and to smile. About the same time it begins to look at bright objects, and frequently to turn its eyes towards the window, a candle, or any light. Now likewise it begins to weep; for its former cries and groans were not accompanied with tears. Smiles and tears are the effect of two internal sensations, both of which depend on the action of the mind. Thus they are peculiar to the human race, and serve to express mental pain or pleasure; while the cries, motions, and other marks of bodily pain and pleasure, are common to man and most of the other animals. Considering the subject as metaphysicians, we will find that pain and pleasure are the universal power which sets all our passions in motion.

The size of an infant born at the full time is commonly twenty-one inches; and that *fetus*, which nine months before was an imperceptible bubble, now weighs ten or twelve pounds, and sometimes more. The head is large in proportion to the body; and this disproportion, which is still greater in the first stage of the *fetus*, continues during the period of infancy. The skin of a new-born child is of a reddish colour, because it is so fine and transparent as to allow a slight tint of the colour of the blood to shine through. The form of the body and members is by no means perfect in a child soon after birth; all the parts appear to be swollen. At the end of three days, a kind of jaundice generally comes on, and at the same time milk is to be found in the breasts of the infant, which may be squeezed out by the fingers. The swelling decreases as the child grows up.

The liquor contained in the amnios leaves a viscid whitish matter upon the body of the child. In this country we have the precaution to wash the new-born infant only with warm water; but it is the custom with whole nations inhabiting the coldest climates, to plunge their infants into cold water as soon as they are born without their receiving the least injury. It is even said that the Laplanders leave their children in the snow till the cold has almost stopped their respiration, and then plunge them into a warm bath. Among these people, the children are also washed thrice a-day during the first year of their life. The inhabitants of northern countries are persuaded that the cold bath tends to make men stronger and more robust, and on that account accustom their children to the use of it from their infancy. The truth is, that we are totally ignorant of the power of habit, or how far it can make our bodies capable of suffering, of acquiring, or of losing.

The child is not allowed to suck as soon as it is born; but time is given for discharging the liquor and

9
and during
the period
of infancy.

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slime from the stomach, and the *meconium* or excrement, which is of a black colour, from the intestines. As these substances might sour the milk, a little diluted wine mixed with sugar is first given to the infant, and the breast is not presented to it before ten or twelve hours have elapsed.

The young of quadrupeds can of themselves find the way to the teat of the mother: it is not so with man. The mother, in order to suckle her child, must raise it to her breasts; and, at this feeble period of life, the infant can express its wants only by its cries.

TO
Peculiar
attention
requisite in
rearing the
young of
mankind.

New-born children have need of frequent nourishment. During the day, the breast ought to be given them every two hours, and during the night as often as they awake. At first they sleep almost continually; and they seem never to awake but when pressed by hunger or pain. Sleep is useful and refreshing to them; and it sometimes becomes necessary to employ narcotic doses, proportioned to the age and constitution of the child, for the purpose of procuring them repose. The common way of appeasing the cries of children is by rocking them in the cradle; but this agitation must be very gentle, otherwise a great risk is run of confusing the infant's brain, and of producing a total derangement. It is necessary to their being in good health, that their sleep be long and natural. It is possible, however, that they may sleep too much, and thereby endanger their constitution. In that case, it would be proper to take them out of the cradle, and awaken them by a gentle motion, or by presenting some bright object to their eyes. At this age we receive the first impressions from the senses, which, without doubt, are more important during the rest of life than is generally imagined. Great care ought to be taken to place the cradle in such a manner that the child shall be directly opposite to the light: for the eyes are always directed towards that part of the room where the light is strongest; and, if the cradle be placed sideways, one of them, by turning towards the light, will acquire greater strength than the other, and the child will squint. For the two first months, no other food should be given to the child but the milk of the nurse; and, when it is of a weak and delicate constitution, this nourishment alone should be continued during the third or fourth month. A child, however robust and healthful, may be exposed to great danger and inconvenience, if any other aliment is administered before the end of the first month. In Holland, Italy, Turkey, and the whole Levant, the food of children is limited to the milk of the nurse for a whole year. The savages of Canada give their children suck for four, five, and sometimes even seven years. In this country, as nurses generally have not a sufficient quantity of milk to satisfy the appetite of their children, they commonly supply the want of it by panada, or other light preparations.

The teeth usually begin to appear about the age of seven months. The cutting of these, although a natural operation, does not follow the common laws of nature, which acts continually on the human body without occasioning the smallest pain or even producing any sensation. Here a violent and painful effort is made, accompanied with cries and tears. Children at first lose their sprightliness and gaiety; they become sad, restless, and fretful. The gums are red, and swelled; but they afterwards become white, when

the pressure of the teeth is so great as to stop the circulation of the blood. Children apply their fingers to their mouth, that they may remove the irritation which they feel there. Some relief is given, by putting into their hands a bit of ivory or of coral, or of some other hard and smooth body, with which they rub the gums at the affected part. This pressure, being opposed to that of the teeth, calms the pain for a moment, contributes to make the membrane of the gum thinner, and facilitates its rupture. Nature here acts in opposition to herself; and an incision of the gum must sometimes take place, to allow a passage to the tooth. For the period of dentition, number of teeth. &c. see ANATOMY, n° 27.

When children are allowed to cry too long and too often, ruptures are sometimes occasioned by the efforts they make. These may easily be cured by the speedy application of bandages; but if this remedy has been too long delayed, the disease may continue through life. Children are very much subject to worms. Some of the bad effects occasioned by these animals might be prevented by giving them a little wine now and then, for fermented liquors have a tendency to prevent their generation.

Though the body is very delicate in the state of infancy, it is then less sensible of cold than at any other part of life. The internal heat appears to be greater: the pulse in children is much quicker than in adults; from which we are certainly intitled to infer, that the internal heat is greater in the same proportion. For the same reason, it is evident that small animals have more heat than large ones; for the beating of the heart and of the arteries is always quicker in proportion to the smallness of the animal. The strokes of the heart in a sparrow succeed one another so rapidly that they can scarcely be counted.

Till three years of age, the life of a child is very precarious. In the two or three following years, it becomes more certain; and at six or seven years of age, a child has a better chance of living than at any other period of life. From the bills of mortality published at London, it appears, that of a certain number of children born at the same time, one half of them die the three first years: according to which, one half of the human race are cut off before they are three years of age. But the mortality among children is not nearly so great every where as in London. *M. Dupre de Saint-Maur*, from a great number of observations made in France, has shown that half of the children born at the same time are not extinct till seven or eight years have elapsed.

Among the causes which have occasioned so great a mortality among children, and even among adults, the small-pox may be ranked as the chief. But luckily the means of alleviating by inoculation the fatal effects of this terrible scourge are now universally known. See INOCULATION, and MEDICINE-Index.

Children begin learning to speak about the age of twelve or fifteen months. In all languages, and among every people, the first syllables they utter are *ba, ba, ma, ma, pa, pa, taba, abada*: nor ought this to excite any surprise, when we consider that these syllables are the sounds most natural to man, because they consist of that vowel, and those consonants, the pronunciation of which require the smallest exertion in the organs of speech. Some children at two years of age articulate

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Man. articulate distinctly, and repeat whatever is said to them; but most children do not speak till the age of two years and a half, or three years, and often later.

The life of man and of other animals is measured only from the moment of birth: they enjoy existence, however, previous to that period, and begin to live in the state of a fetus. This state is described and explained under the article *ANATOMY*, n° 110. The period of infancy, which extends from the moment of birth to about twelve years of age, has just now been considered.

13
Period of
puberty and
adolescence.

The period of infancy is followed by that of adolescence. This begins, together with puberty, at the age of twelve or fourteen, and commonly ends in girls at fifteen, and in boys at eighteen, but sometimes not till twenty-one, twenty-three, and twenty-five years of age. According to its etymology (being derived from the Latin word *adolescencia*), it is completed when the body has attained its full height. Thus, puberty accompanies adolescence, and precedes youth. This is the spring of life; this is the season of pleasures, of loves, and of graces: but alas! this smiling season is of short duration. Hitherto nature seems to have had nothing in view but the preservation and increase of her work: she has made no provision for the infant except what is necessary to its life and growth. It has lived, or rather enjoyed a kind of vegetable existence, which was shut up within itself, and which it was incapable of communicating. In this first stage of life, reason is still asleep: but the principles of life soon multiply, and man has not only what is necessary to his own existence, but what enables him to give existence to others. This redundancy of life, this source of health and vigour, can no longer be confined, but endeavours to diffuse and expand itself.

14
Symptoms
of puberty.

The age of puberty is announced by several marks. The first symptom is a kind of numbness and stiffness in the groins, accompanied with a new and peculiar sensation in those parts which distinguish the sexes. There, as well as in the arm-pits, small protuberances of a whitish colour appear, which are the germs of a new production of a kind of hair, by which these parts are afterwards to be veiled. The voice, for a considerable time, is rough and unequal; after which it becomes fuller, stronger, and graver, than it was before. This change may easily be distinguished in boys; but less so in girls, because their voices are naturally sharper. These marks of puberty are common to both sexes: but there are marks peculiar to each, such as the discharge of the menses, and the growth of the breasts, in girls; the beard, and the emission of semen, in boys; in short, the feeling of venereal desire, and the appetite which unites the sexes. Among all races of mankind, the females arrive at puberty sooner than the males; but the age of puberty is different in different nations, and seems partly to depend on the temperature of the climate and the quality of the food. In the southern countries of Europe, and in cities, the greatest part of girls arrive at puberty about twelve, and boys about fourteen years of age. But in the northern parts, and in the country, girls scarcely arrive at puberty till they are fourteen or fifteen, and boys not till they are sixteen or seventeen. In our climate, girls, for the greatest part, have attained complete maturity at eighteen, and boys at twenty years of age.

At the age of adolescence, and of puberty, the body commonly attains its full height. About that time, young people shoot out several inches almost at once. But there is no part of the human body which increases more quickly and more perceptibly than the organs of generation in both sexes. In males, this growth is nothing but an unfolding of the parts, an augmentation in size; but in females, it often occasions a shrinking and contraction, which have received different names from those who have treated of the signs of virginity. See *VIRGINITY*.

Marriage is a state suitable to man, wherein he must make use of those new faculties which he has acquired by puberty. At this period of life, the desire of producing a being like himself is strongly felt. The external form and the correspondence of the organs of sex, occasion without doubt that irresistible attraction which unites the sexes and perpetuates the race. By connecting pleasure with the propagation of the species, nature has provided most effectually for the continuance of her work. *Increase and multiply*, is the express command of the Creator, and one of the natural functions of life. We may add, that at the age of puberty a thousand impressions act upon the nervous system, and reduce man to such a situation that he feels his existence only in that voluptuous sense, which then appears to become the seat of his soul, which engrosses the whole sensibility of which he is susceptible, and which at length proceeds to such a height, that its attacks cannot long be supported without a general derangement of the whole machine. The continuance of such a feeling may sometimes indeed prove fatal to those who indulge in excessive enjoyment; but it is equally dangerous to those who obstinately persist in celibacy, especially when strongly solicited by nature. The semen, being too long confined in the seminal vessels, may, by its stimulant property, occasion diseases in both sexes, and excite irritations so violent as to reduce man to a level with the brutes, which, when acted upon by such impressions, are perfectly furious and ungovernable. When this irritation proceeds to extremity, it produces what is called the *furor uterinus* in women. The opposite habit, however, is infinitely more common, especially in the temperate, and above all in the frozen zones. After all, excess is much more to be dreaded than continency. The number of dissolute and intemperate men afford us plenty of examples. Some have lost their memory, some have been deprived of sight, some have become bald, and some have died through mere weakness. In such a case, bleeding is well known to be fatal. Young men cannot be too often warned of the irreparable injury they may do to their health; and parents, to whose care they are entrusted, ought to employ all the means in their power to turn them from such dangerous excesses. But at the age of puberty, young men know not of how great importance it is to prolong this smiling season of their days, of which whereon the happiness or misery of their future life so much depends. Then they look not forwards to futurity, nor reflect on what is past, nor enjoy present pleasures with moderation. How many cease to be men, or at least to have the faculties of men, before the age of thirty? Nature must not be forced: like a true mother, her object is the sober and discreet union of the sexes. It is sufficient to obey when the commands, and to answer when the calls. Neither must

Man. **15**
Effects of
puberty.

16
Its too frequent abuse.

17
Great importance of this season of life.

Man.

we forget here to mention and condemn an outrage committed against nature, the shameful practice of which endangers the loss of health, and the total ruin of the constitution; we mean that solitary libertinism (*maslurbatio*), by which a man or woman, deceiving nature as it were, endeavours to procure those enjoyments which religion has forbidden except when connected with the happiness of being a parent. Such then is the physical order which the Author of nature, the great preserver of the species as well as of the individual, has appointed to induce man, by the attraction of pleasure, to propagate and continue his race.

The procreation of children is the object of marriage; but sometimes this object fails to be accomplished. See IMPOTENCE and STERILITY.

18

Of procreation.

According to the ordinary course of nature, women are not fit for conception till after the first appearance of the menses. When these stop, which generally happens about forty or fifty years of age, they are barren ever after. Their breasts then shrink and decay, and the voice becomes feeble. Some, however, have become mothers before they have experienced any menstrual discharge; and others have conceived at the age of sixty, and sometimes at a more advanced age. Such examples, though not infrequent, must be considered as exceptions to the general rule; but they are sufficient to show that the menstrual discharge is not essential to generation. The age at which man acquires the faculty of procreating is not so distinctly marked. In order to the production of semen, the body must have attained a certain growth, which generally happens between twelve and eighteen years of age. At sixty or seventy, when the body begins to be enervated by old age, the voice becomes weaker, the semen is secreted in smaller quantities, and it is often unprolific. There are instances, however, of old men who have procreated at the age of eighty or ninety. Boys have been found who had the faculty of generating at nine, ten, or eleven years of age; and young girls who have become pregnant at the age of seven, eight, or nine. But such facts, which are very rare, ought to be considered as extraordinary phenomena in the course of nature.

19

Pregnancy.

Pregnancy is the time during which a woman carries in her womb the fruit of conception. It begins from the moment the prolific faculty has been reduced into act, and all the conditions requisite in both sexes have concurred to form the rudiments of a male or female fetus; and it ends with delivery. As soon as a woman is declared pregnant, says the author of the essay *Sur la maniere de perfectionner l'espece humaine*, she ought to direct her attention wholly to herself, and make the wants of her offspring the standard of her actions. She is now become the depositary of a new creature similar to herself, and differing only in the proportion and successive unfolding of its parts. She must be highly careful not to lace herself tight, to avoid excessive stretchings, and, in short, to disturb in no respect the natural state of the womb. She must likewise beware of indulging certain passions, for we shall afterwards see what great changes are produced in the animal economy by strong and violent passions.

An explanation, then, of what takes place during

Man.

pregnancy, is nothing but a history of the formation of the fetus; of its expansion; of the extraordinary manner in which it lives, is nourished, and grows in its mother's womb; and of the way in which all these operations are performed with regard to both: for which see ANATOMY, n° 109, 110. It has been proved by many observations, that the fetus changes its position in the womb, according to the different attitudes of the mother. It is commonly situated with its feet downwards, the breech resting upon the heels, the head bent towards the knees, the hands bent towards the mouth, the feet turned inwards; and in this position it swims like a kind of vessel in the watery fluid contained in the membranes by which it is surrounded, without occasioning any inconvenience to the mother, except what arises from its motions, sometimes to the one side, and sometimes to the other. At times, it even kicks with such violence as to frighten the mother. But when once the head becomes sufficiently large to destroy the equilibrium, it tumbles over and falls downwards; the face is turned towards the *os sacrum*, and the crown of the head towards the orifice of the *uterus*. This happens six weeks or two months before delivery. When the time of delivery arrives, the fetus, finding itself too much confined in the womb, makes an effort to escape with its head first. At length, at the moment of delivery, it unites its own strength with that of the mother, and opens the orifice of the *uterus* wide enough to allow a passage for itself. It happens sometimes that the fetus escapes from the *uterus* without bursting its covering, as is the case with animals. But, in general, the human fetus pierces the membranes by its efforts; and sometimes a very thin part of them remains upon the head like a cap. The ancients considered this membranous covering as a sign of good fortune; and the same idea is still prevalent among the vulgar. The liquor which escapes during delivery is called the *waters* of the mother. These waters serve to guard the fetus from external injuries, by eluding the violence of the blows which the mother may receive upon the belly; and, in the same manner, they defend the womb from the shocks occasioned by the motions of the fetus. In short, by rendering the passages soft and pliable, they facilitate the escape of the child in the time of delivery. (See MIDWIFERY.)—In the womb, the fetus does not respire, as has been already mentioned; consequently what has been said of the cries of children in the womb, must be considered as altogether fabulous.—Women have generally only one child at a birth. When they bear two, three, or more, the fetuses are seldom found under the same covering; and their placenta, though adhering, are almost always distinct. Twins are not uncommon, but there are seldom more. It is supposed, that among women with child, there is only one in 2500 who brings forth three children at a birth, one in 20,000 who brings forth four, and one in a million who brings forth five. When the number amounts to five, or even when there are but three or four, they are generally of a weakly constitution; most of them die in the womb, or soon after delivery. See the article PROLIFIC.

At the age of puberty, or a few years after, the body attains its full stature. Some young men grow

Man.
21
Period of
youth.

no taller after 15 or 16, and others continue to grow till the age of 20 or 23. At this period they are very slender; but by degrees the members swell and begin to assume their proper shape; and before the age of 30, the body in men has attained its greatest perfection with regard to strength, confidence, and symmetry. Adolescence ends at the age of 20 or 25; and at this period youth (according to the division which has been made of the years of man's life into different ages) begins. It continues till the age of 30 or 35.

22
Stature of
man.

The common stature of men is about five feet and three, four, five, six, or seven inches; and of women about five feet and two, three, or four inches. Men below five feet are of a small stature. The Laplanders do not exceed four feet and a half; and the natives of some other countries are still smaller. Women attain their full height sooner than men. Haller computes, that in the temperate climates of Europe, the medium stature of men is about five feet and five or six inches. It is observed by the same author, that in Switzerland the inhabitants of the plains are taller than those of the mountains. It is difficult to ascertain with precision the actual limits of the human stature. In surveying the inhabited earth, we find greater differences in the statures of individuals than in those of nations. In the same climate, among the same people, and sometimes in the same family, there are men whose stature is either too tall or too diminutive. See the articles GIANT and DWARF.

23
State of
manhood

The body having acquired its full height during the period of adolescence, and its full dimensions in youth, remains for some years in the same state before it begins to decay. This is the period of manhood, which extends from the age of 30 or 35 to that of 40 or 45 years. During this stage, the powers of the body continue in full vigour, and the principal change which takes place in the human figure arises from the formation of fat in different parts. Excessive fatness disfigures the body, and becomes a very cumbersome and inconvenient load.

24
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“The body of a well-shaped man ought to be square, the muscles ought to be strongly marked, the contour of the members boldly delineated, and the features of the face well defined. In women, all the parts are more rounded and softer, the features are more delicate, and the complexion brighter. To man belong strength and majesty; gracefulness and beauty are the portion of the other sex. The structure essential to each will be found in the description of the human skeleton, under the article ANATOMY.

Every thing in both sexes points them out as the sovereigns of the earth; even the external appearance of man declares his superiority to other living creatures. His body is erect; his attitude is that of command; his august countenance, which is turned towards heaven, bears the impressions of his dignity. The image of his soul is painted in his face; the excellence of his nature pierces through the material organs, and gives a fire and animation to the features of his countenance. His majestic deportment, his firm and emboldened gait, announce the nobleness of his rank. He touches the earth only with his extremity: he views it only at a distance, and seems to despise it. It has been justly observed, that the countenance

of man is the mirror of his mind. In the looks of no animal are the expressions of passion painted with such energy and rapidity, and with such gentle gradations and shades, as in those of man. We know, that in certain emotions of the mind, the blood rises to the face, and produces blushing; and that in others, the countenance turns pale. These two symptoms, the appearance of which depends on the structure and the transparency of the reticulum, especially redness, constitute a peculiar beauty. In our climates, the natural colour of the face of a man in good health is white, with a lively red suffused upon the cheeks. Paleness of the countenance is always a suspicious symptom. That colour which is shaded with black is a sign of melancholy and of vitiated bile; and constant and universal redness is a proof that the blood is carried with too great impetuosity to the brain. A livid colour is a morbid and dangerous symptom; and that which has a tint of yellow is a sign of jaundice or repletion of bile. The colour of the skin is frequently altered by want of sleep or of nourishment, or by looseness and diarrhoea.

Notwithstanding the general similitude of countenance in nations and families, there is a wonderful diversity of features. No one, however, is at a loss to recollect the person to whom he intends to speak, provided he has once fully seen him. One man has liveliness and gaiety painted in his countenance, and announces before-hand, by the cheerfulness of his appearance, the character which he is to support in society. The tears which bedew the cheeks of another man would excite compassion in the most unfeeling heart. Thus the face of man is the rendezvous of the symptoms both of his moral and physical affections: tranquility, anger, threatening, joy, smiles, laughter, malice, love, envy, jealousy, pride, contempt, disdain or indignation, irony, arrogance, tears, terror, astonishment, horror, fear, shame or humiliation, sorrow and affliction, compassion, meditation, particular convulsions, sleep, death, &c. &c. The difference of these characters appears to us of sufficient importance to form a principal article in the natural history of man.

When the mind is at ease, all the features of the face are in a state of profound tranquility. Their proportion, harmony, and union, point out the serenity of the thoughts. But when the soul is agitated, the human face becomes a living canvas, whereon the passions are represented with equal delicacy and energy, where every emotion of the soul is expressed by some feature, and every action by some mark; the lively impression of which anticipates the will, and reveals by pathetic signs our secret agitation, and those intentions which we are anxious to conceal. It is particularly in the eyes that the soul is painted in the strongest colours and with the most delicate shades.

The different colours of the eyes are, dark hazel, light hazel, green, blue, gray, and whitish-gray. The most common of these colours are hazel and blue, both of which are often found in the same eye. Eyes which are commonly called black, are only dark hazel; they appear black in consequence of being contrasted with the white of the eye. Wherever there is a tint of blue, however slight, it becomes the prevailing colour, and outshines

Man.

25
Diversity of
the counte-
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26
Analysis of
the fea-
tures.

Man.

Man.

outlines the hazel, with which it is intermixed, to such a degree, that the mixture cannot be perceived without a very narrow examination. The most beautiful eyes are those which appear black or blue. In the former, there is more expression and vivacity; in the latter, more sweetness and perhaps delicacy.

Next to the eyes, the parts of the face by which the physiognomy is most strongly marked, are the eye-brows. Being of a different nature from the other parts, their effect is increased by contrast. They are like a shade in a picture, which gives relief to the other colours and forms.

The forehead is one of the largest parts of the face, and contributes most to its beauty. Every body knows of how great importance the hair is in the physiognomy, and that baldness is a very great defect. When old age begins to make its approaches, the hair which first falls off is that which covers the crown of the head and the parts above the temples. We seldom see the hair of the lower part of the temples, or of the back of the head, completely fall off. Baldness is peculiar to men: women do not naturally lose their hair, tho' it becomes white as well as that of the men at the approach of old age.

The nose is the most prominent feature of the face. But as it has very little motion, and that only in the most violent passions, it contributes less to the expression than to the beauty of the countenance. The nose is seldom perpendicular to the middle of the face, but for the most part is turned to one side or the other. The cause of this irregularity, which, according to the painters, is perfectly consistent with beauty, and of which even the want would be a deformity, appears to be frequent pressure on one side of the cartilage of the child's nose against the breast of the mother when it receives suck. At this early period of life, the cartilages and bones have acquired very little solidity, and are easily bent, as may be observed in the legs and thighs of some individuals, who have been injured by the bandages of the swaddling clothes.

Next to the eyes, the mouth and lips have the greatest motion and expression. These motions are under the influence of the passions. The mouth, which is set off by the vermilion of the lips and the enamel of the teeth, marks, by the various forms which it assumes, their different characters. The organ of the voice likewise gives animation to this feature, and communicates to it more life and expression than is possessed by any of the rest. The cheeks are uniform features, and have no motion or expression excepting from that involuntary redness or paleness with which they are covered in different passions, such as shame, anger, pride, and joy, on the one hand; and fear, terror, and sorrow, on the other.

In different passions, the whole head assumes different positions, and is affected with different motions. It hangs forward during shame, humility, and sorrow; it inclines to one side in languor and compassion; it is elevated in pride, erect and fixed in obstinacy and self-conceit: In astonishment it is thrown backwards; and it moves from side to side in contempt, ridicule, anger, and indignation.

In grief, joy, love, shame, and compassion, the eyes swell, and the tears flow. The effusion of tears is

always accompanied with an extension of the muscles of the face, which opens the mouth.

In sorrow, the corners of the mouth are depressed, the under-lip rises, the eye-lids fall down, the pupil of the eye is raised and half concealed by the eye-lid. The other muscles of the face are relaxed, so that the distance between the eyes and the mouth is greater than ordinary; and consequently the countenance appears to be lengthened.

In fear, terror, consternation, and horror, the forehead is wrinkled, the eye-brows are raised, the eye-lids are opened as wide as possible, the upper lid uncovers a part of the white above the pupil, which is depressed and partly concealed by the under lip. At the same time, the mouth opens wide, the lips recede from each other, and discover the teeth both above and below.

In contempt and derision, the upper lip is raised at one side and exposes the teeth, while the other side of the lip moves a little and wears the appearance of a smile. The nostril on the elevated side of the lip shrivels up, and the corner of the mouth falls down. The eye on the same side is almost shut, while the other is open as usual; but the pupils of both are depressed, as when one looks down from a height.

In jealousy, envy, and malice, the eye-brows fall down and are wrinkled; the eye-lids are elevated, and the pupils are depressed. The upper lip is elevated on both sides, while the corners of the mouth are a little depressed, and the under lip rises to join the middle of the upper.

In laughter, the corners of the mouth are drawn back and a little elevated; the upper parts of the cheeks rise; the eyes are more or less closed; the upper lip rises, and the under one falls down; the mouth opens; and in cases of immoderate laughter, the skin of the nose wrinkles. That gentler and more gracious kind of laughter which is called *smiling*, is seated wholly in the parts of the mouth. The under lip rises; the angles of the mouth are drawn back; the cheeks are puffed up; the eye-lids approach one another; and a small twinkling is observed in the eyes. It is very extraordinary, that laughter may be excited either by a moral cause without the immediate action of external objects, or by a particular irritation of the nerves without any feeling of joy. Thus an involuntary laugh is excited by a slight tickling of the lips, of the palm of the hand, of the sole of the foot, of the arm-pits, and, in short, below the middle of the ribs. We laugh when two dissimilar ideas, the union of which was unexpected, are presented to the mind at the same time, and when one or both of these ideas, or their union, includes some absurdity which excites an emotion of disdain mingled with joy. In general, striking contrasts never fail to produce laughter.

A change is produced in the features of the countenance by weeping as well as by laughing. When we weep, the under lip is separated from the teeth, the forehead is wrinkled, the eye-brows are depressed: the dimple, which gives a gracefulness to laughter, forsakes the cheek: the eyes are more compressed, and almost constantly bathed in tears, which in laughter flow more seldom and less copiously.

The

Man.

The arms, hands, and every part of the body, contribute to the expression of the passions. In joy, for instance, all the members of the body are agitated with quick and various motions. In languor and sorrow, the arms hang down, and the whole body remains fixed and immovable. In admiration and surprize, this total suspension of motion is likewise observed. In love, desire, and hope, the head and eyes are raised to heaven, and seem to solicit the wished-for good; the body leans forward as if to approach it; the arms are stretched out, and seem to seize before-hand the beloved object. On the contrary, in fear, hatred, and horror, the arms seem to push backward and repel the object of our aversion; we turn away our head and eyes as if to avoid the sight of it; we recoil in order to shun it.

Although the human body is externally much more delicate than that of any other animal, yet it is very nervous, and perhaps stronger in proportion to its size than that of the strongest animals. We are assured that the porters at Constantinople carry burdens of 500 pounds weight. A thousand wonderful stories are related of the Hottentots and other savages concerning their agility in running. Civilized man knows not the full extent of his powers, nor how much he loses by that effeminacy and inactivity by which they are weakened and destroyed. He is contented even to be ignorant of the strength and vigour which his members are capable of acquiring by motion, and by being accustomed to severe exercises, as is observed in runners, tumblers, and rope-dancers. The conclusion is, therefore, founded on the most just and indisputable induction and analogy.—The attitude of walking is less fatiguing to man than that in which he is placed when he is stopped in running. Every time he sets his foot upon the ground, he passes over a more considerable space; the body leans forwards, and the arms follow the same direction; the respiration increases, and breathing becomes difficult. Leaping begins with great inflexions of the members; the body is then much shortened, but immediately stretches itself out with a great effort. The motions which accompany leaping make it very fatiguing.

29
Restoration
of its pow-
ers by sleep

It is observed by M. Daubenton (*Nouvelle Encyclopédie*), that a cessation from exercise is not alone sufficient to restore the powers of the body when they are exhausted by fatigue. The springs, though not in action, are still wound up while we are awake, even when every movement is suspended. In sleep nature finds that repose which is suited to her wants, and the different organs enjoy a salutary relaxation. This is that wonderful state in which man, unconscious of his own existence, and sunk in apparent death, repairs the loss which his faculties has sustained, and seems to assume a new existence. In this state of drowsiness and repose, the senses cease to act, the functions of the soul are suspended, and the body seems abandoned to itself. The external symptoms of sleep, which alone are the object of our attention, are easily distinguished. At the approach of sleep, the eyes begin to wink, the eye-lids fall down, the head nods and hangs down: its fall astonishes the sleeper; he starts up, and makes an effort to drive away sleep, but in vain; a new inclination, stronger than the former, deprives him of the power of raising his head; his chin rests upon

his breast, and in this position he enjoys a tranquil sleep. See the article SLEEP.

Physiologists give the name of old age to that period of life which commences immediately after the age of manhood and ends at death; and they distinguish green old age from the age of decrepitude. But in our opinion, such an extensive signification of the word ought not to be admitted. We are not old men at the age of forty or forty-five; and though the body then gives signs of decay, it has not yet arrived at the period of old age. M. Daubenton observes, that it would be more proper to call it the *declining age*, because nature then becomes retrograde, the fatness and good plight of the body diminishes, and certain parts of it do not perform their functions with equal vigour.

The age of decline extends from forty or forty-five to sixty or sixty-five years of age. At this time of life, the diminution of the fat is the cause of those wrinkles which begin to appear in the face and some other parts of the body. The skin, not being supported by the same quantity of fat, and being incapable, from want of elasticity, of contracting, sinks down and forms folds. In the decline of life, a remarkable change takes place also in vision. In the vigour of our days, the crystalline lens, being thicker and more diaphanous than the humours of the eye, enables us to read letters of a very small character at the distance of eight or ten inches. But when the age of decline comes on, the quantity of the humours of the eye diminishes, they lose their clearness, and the transparent cornea becomes less convex. To remedy this inconvenience, we place what we wish to read at a greater distance from the eye: but vision is thereby very little improved, because the image of the object becomes smaller and more obscure. Another mark of the decline of life is a weakness of the stomach, and indigestion, in most people who do not take sufficient exercise in proportion to the quantity and the quality of their food.

At sixty, sixty-three, or sixty-five years of age, the signs of decline become more and more visible, and indicate *old age*. This period commonly extends to the age of seventy, sometimes to seventy-five, but seldom to eighty. When the body is extenuated and bent by old age, man then becomes crazy. Crazynefs therefore is nothing but an *infirm old age*. The eyes and stomach then become weaker and weaker; leannefs increases the number of the wrinkles; the beard and the hair become white; the strength and the memory begin to fail.

After seventy, or at most eighty years of age, the life of man is nothing but labour and sorrow: Such was the language of David near three thousand years ago. Some men of strong constitutions, and in good health, enjoy old age for a long time without decrepitude; but such instances are not very common. The infirmities of decrepitude continually increase, and at length death concludes the whole. This fatal term is uncertain. The only conclusions which we can form concerning the duration of life, must be derived from observations made on a great number of men who were born at the same time, and who died at different ages. These we shall mention in the sequel.

The signs of decrepitude form a striking picture of weakness, and announce the approaching dissolution of

Man.

30
The period
of decline.

31
Old age.

³² Man. of the body. The memory totally fails; the nerves become hard and blunted; deafness and blindness take place; the senses of smell, of touch, and of taste, are destroyed; the appetite fails; the necessity of eating, and more frequently that of drinking, are alone felt; after the teeth fall out, mastication is imperfectly performed, and digestion is very bad; the lips fall inwards; the edges of the jaws can no longer approach one another; the muscles of the lower jaw become so weak, that they are unable to raise and support it: the body sinks down; the spine is bent outward; and the vertebrae grow together at the anterior part: the body becomes extremely lean; the strength fails: the decrepid wretch is unable to support himself; he is obliged to remain on a seat, or stretched in his bed: the bladder becomes paralytic; the intestines lose their spring; the circulation of the blood becomes slower; the strokes of the pulse no longer amount to the number of eighty in a minute as in the vigour of life, but are reduced to twenty-four and sometimes fewer; respiration is slower; the body loses its heat; the circulation of the blood ceases; death follows; and the dream of life is no more.

³³ Man naturally formed for long life. Man, says Haller in his Physiology, has no right to complain of the shortness of life. Throughout the whole of living beings, there are few who unite in a greater degree all the internal causes which tend to prolong its different periods. The term of gestation is very considerable; the rudiments of the teeth are very late in unfolding; his growth is slow, and is not completed before about twenty years have elapsed.—The age of puberty, also, is much later in man than in any other animal. In short, the parts of his body being composed of a softer and more flexible

substance, are not so soon hardened as those of inferior animals. Man, therefore, seems to receive at his birth the seeds of a long life: if he reaches not the ditant period which nature seemed to promise him, it must be owing to accidental causes foreign to himself. Instead of saying that he has finished his life, we ought rather to say that he has not completed it.

The natural and total duration of life is in some measure proportioned to the period of growth. A tree or an animal which soon acquires its full size, decays much sooner than another which continues to grow for a longer time. If it is true that the life of animals is eight times longer than the period of their growth, we might conclude that the boundaries of human life may be extended to a century and a half.

It does not appear that the life of man becomes shorter in proportion to the length of time the world of life has existed. In the days of the Psalmist, the ordinary limits of human life did not exceed seventy or eighty years. No king of Judah lived beyond that period. When the Romans, however, were numbered by Vespasian, there were found in the empire, in that age of effeminacy, ten men aged an hundred and twenty and upwards. Among the princes of modern times, the late Frederick the Great of Prussia lived to the age of 74. George II. of Britain lived to that of 77. Louis XIV. lived to the same age. Stanislaus king of Poland and duke of Lorrain exceeded that age. Pope Clement XII. lived to the age of 80. George I. of Britain attained the age of 83. M. Bomare has collected divers instances of persons who lived to the age of 110 and upwards, of which we shall in a note (p) specify a few in Supplement to those already given under the article LONGEVITY.

Before

(p) William Lecomte, a shepherd, died suddenly in 1776, in the county of Caux in Normandy, at the age of 110. Cramers, physician to the emperor, saw at Temeswar two brothers, the one aged 110 and the other 112, both of whom were fathers at that age. Saint Paul the hermit was 113 at his death. The Sieur Iswan-Horwaths, knight of the order of St Louis, died at Sar-Albe in Lorrain in 1775, aged almost 111. He was a great hunter. He undertook a long journey a short time before his death, and performed it on horseback. Rosine Iwiwarouika died at Minsk in Lithuania at the age of 113. Pockjel Johannes died at Oldeborn in Friesland, aged 113 years and 16 days. Mark Jonas died in the year 1775 at Vilkjæ in Hungary, aged 119. John Nietlen of Bakler in Zeland lived to the age of 120. Eleonora Spicer died in 1773, at Accomack in Virginia, aged 121. John Argus was born in the village of Laftua in Turkey, and died the 6th of March 1779, at the age of 123; having six sons and three daughters, by whom he had posterity to the fifth generation. They amounted to the number of 160 souls, and all lived in the same village. His father died at the age of 120. In December 1777, there lived in Devonshire a farmer named John Brooker, who was 134 years of age, and had been fifteen times married. The Philosophical Transactions mention an Englishman of the name of *Ecclifson*, who lived to the age of 143. Another Englishman of the name of *Effingham*, died in 1757 at the age of 144. Niels Jukens of Hamerlet in Denmark died in 1764, aged 146. Christian Jacob Drakemberg died in 1770 at Archulen, in the 146th year of his age. This old man of the north was born at Stavanger in Norway in 1624, and at the age of 130 married a widow of 60. In Norway some men have lived to the age of 150. John Rovin, who was born at Szatlova-Carantz-Betcher, in the bannat of Temeswar, lived to the age of 172, and his wife to that of 164, having been married to him during the space of 147 years. When Rovin died, their youngest son was 99 years of age. In the *Gazette de France*, Jan. 18th 1780, we are informed that there lived at that time at Cordova du Tucuman, in Spanish America, a negro woman called *Louisa Trexo*, who, by the judicial testimony of several persons 100 years old, and of a negro woman of 120, was aged between 174 and 175 years. Peter Zoten, a peasant, and a countryman of John Rovin, died in 1724 at the age of 185. His youngest son was then 97 years of age. The history and whole length pictures of John Rovin, Henry Jenkins, and Peter Zorten, are to be seen in the library of S. A. R. prince Charles at Brussels. Hanovius, professor at Dantzick, mentions in his nomenclature an old man who died at the age of 184; and another still alive in Wallachia, whose age, according to this author, amounts to 186. *Dictionnaire d'Hist. Nat.* voce HOMME.

³⁵ Remarks on instances of longevity.

Man.
36
Chief causes of longevity.

Before we proceed to assign the common causes of longevity, it is proper to inquire into the manner of life and the situation of those by whom it has been enjoyed. We find, then, that those who have lived to the greatest age have been such as did not attain their full growth till a very advanced period of life, and who have kept their appetites and passions under the most complete subjection. In a word, those who have exceeded 100 years, have in general been robust, laborious, sober, and careful to observe the strictest regimen. Enjoying a good constitution from nature, they have seldom or never been subject to disease. They have even enjoyed the greatest health and vigour, and retained the use of their senses to the last moment of their lives.

Among those who have led a life of contemplation and study, many have reached a very advanced age. Longevity is frequent among the different orders of religious, who by their statutes are confined to a moderate diet, and obliged to abstain from wine and the use of meat. Some celebrated anchorites have lived to a great age while they fed upon nothing but the wild roots and fruits which they found in the desert whither they had retired. The philosopher Xenophilus, who lived to the age of 106, was of the Pythagorean sect. It is well known, that those philosophers who held the transmigration of souls, denied themselves the use of meat, because they imagined that killing an animal would be to assassinate another self. A country life has produced many sound and vigorous old men. It is supposed that a happy old age is attained with greater difficulty in towns than in the country. Sir Hans Sloane, Duverney, and Fontenelle, however, are instances of men whose lives have been spent in cities, and yet extended to a very great length. It has been observed, that men deprived of reason live very long; and this Dr Haller imputes to their being exempted from those inquietudes which he considers as the most deadly poison. Persons possessing a sufficiently good understanding, but destitute of ambition, have been found to enjoy very long life. Men who are devoid of pretensions, who are free from those cares which a desire of shining by a display of talents, or of acquiring dignity and power, necessarily brings in its train, who feel no regret for the past nor anxiety about the future, are strangers to those torments of the mind which waste and consume the body. To that tranquillity of soul, which is so excellent a prerogative of infancy, they add that of being long young by physical constitution on which the moral has a striking and powerful influence.

Premature wildom, and early talents, are often fitter to excite astonishment than expectation. The rapid unfolding of the moral faculties, by shortening the period of youth, seems to diminish in proportion the total duration of life. We have known a young lady of seventeen, who could speak very correctly seven languages: she translated and wrote Latin, Greek, Italian, Spanish, German, English, and French; but she died at the age of eighteen. The young man by whom she was asked in marriage, having been informed that he could not obtain her hand till he had made himself worthy of her by the same degree of talents and information, died the same year, and at

N^o 193.

the same age. But in some families, the web of life, to use an expression of Haller, seems to be better warped than in others: of this kind were the families of *Thomas Parr*, mentioned under *LONGEVITY*; and *John Argus*, mentioned in the foregoing note.

From the preceding observations, Dr Haller has attempted to deduce the causes why a few men are longer exempted than others from the common fate.

The circumstances which oppose their influence are independent of our will; such as the ravages of epidemic distempers, trouble, and anxiety of mind, which create diseases in the body, or the torments of ambition. It is necessary to live in a salubrious climate, to enjoy a fortune sufficiently easy to exclude those uneasy desires which create a feeling of want and privation, to be descended from healthy parents, to avoid drinking wine in youth, to drink water, and to eat little meat and a great deal of vegetables. It is necessary also to be temperate in meals; moderate in pleasures, study, and exercise; to be naturally inclined to cheerfulness; and to allot a due time to sleep and repose.

Long life is certainly very rare; but, as has been already observed, we must distinguish between what is natural to the constitution of man, and that which is the consequence of his condition. By the former he is made to be long lived; but nature is arrested in her course by local and accidental causes, which it is not in our power to avoid.

Let us take a retrospective view of man's life from his infancy, and enumerate the chief of these different causes. Of a thousand infants, an account of which Dr Haller has extracted from the London bills of mortality, twenty-three died almost as soon as they came into the world: teething carried off fifty, and convulsions two hundred and seventy-seven: eighty died of the small pox, and seven of the measles. Among the adult females, eight at least died in child-bed: consumption and asthma, diseases more frequent in England than in France, carried off an hundred and ninety-one of the same sex, and almost a fifth part of the full grown men. An hundred and fifty died of fever. At a more advanced age, twelve died of apoplexy, and forty-one of dropsy, without mentioning those to whom diseases of little importance in themselves became mortal. There only remained seventy-eight whose death could be ascribed to old age; and of these twenty-seven lived to the age of eighty and upwards. Among the different diseases of which we have just now seen the fatal effects, and which carry off more than nine-tenths of mankind, not one, it must be allowed, is natural to the constitution. The inhabitants of this island are in general but little subject to diseases, excepting the small-pox and the measles; and many of them enjoy uninterrupted health to old age.

What are the most prevalent diseases in other countries, which prove equally fatal to the duration of human life? In northern climates, scurvy, the colic of the Laplanders, and diseases of the lungs, most frequently occasion death. In temperate climates, dropsy carries off a great many at the beginning of old age, which is the boundary of life in the greatest part of both sexes, when they have escaped the acute diseases, such as putrid fever, &c. Acute diseases are most common in warm countries. In some places, the rays

Man.

of the sun kill in a few hours those who are exposed to its burning heat. The air of Egypt and of Asia Minor engenders the plague, by which one half of their inhabitants are carried off. Between the tropics men are subject to dysenteries and violent fevers. The cold of the night, in warm climates, occasions sometimes violent diseases, such as palsy, quinsy, and a swelling of the head. Damp and marshy places give rise to fevers of a different kind, but also very dangerous. The life of sailors has a great tendency to produce scurvy. How many professions prove fatal to the health, and in most men hasten that period which nature would have brought on by slow degrees! Miners, stone-cutters, gilders, persons employed in emptying privies, &c. are subject to diseases of the lungs, and become paralytic. Other professions of life bring on other accidents, of which it would carry us too far to give a particular account. What has been said is sufficient to show, that it is the dangers with which we are surrounded that shorten the period of human life.

By examining the list of those who have attained a great age, it will be found that mankind are longer lived in northern than in southern countries. It has been observed, that there are more old men in mountains and elevated situations than in plains and low countries. We repeat it, if the duration of life among the inhabitants of southern climates be compared with the duration of life in northern nations, it will be allowed, that the latter enjoy both longer life and better health than the former. Their growth being retarded by the rigour of the climate, their decay must also be slower, because of the proportion which exists between the growth of animals and the length of their lives. Among ten persons who have lived to the age of an hundred, eight or nine will be found to have lived in the north.

38
More women than men attain to old age

It appears from the bills of mortality, that in the country more boys are born than girls: in cities, on the contrary, the number of females is commonly greatest. Observations made with great care prove, that in most countries there are fewer men alive than women, and that more males die, chiefly at the first and last periods of life. In Sweden, the whole number of females in 1763, was to that of males in the proportion of ten to nine. The number of old women who exceeded 80 years of age, was to that of old men of the same age in the proportion of 33 to 19: and there were more women than men who had attained the age of 86, in the proportion of almost two to one.

39
Villages more favourable than towns to longevity.

The late Dr Price made observations, after Dr Percival, on the difference of longevity, and the duration of human life, in towns, country-parishes, and villages; of which the following is the result. A greater number in proportion die in great towns than in small ones, and a greater number in the latter than in villages. The cause of this difference, which is found to be very great, must be, in the first place, the luxury and dissipation which prevail in towns; and, secondly, the badness of the air. In the town of Manchester, according to observation, $\frac{1}{8}$ of the inhabitants die annually; whereas, in the neighbouring country, the number of deaths does not exceed $\frac{1}{10}$ of the whole inhabitants. It may be laid down as a general principle, that in

Vol. X. Part II.

great towns, the number of deaths annually is from 1 in 10 to 1 in 22 or 23; in middling towns, from 1 in 24 to 1 in 28; and in country parishes and villages seldom more than 1 in 40 or 50. In 1763, the number of inhabitants in Stockholm amounted to 72,979. The average number of deaths for the six years preceding had been 3802, which makes 1 in 19 annually; while throughout all Sweden, including the towns and the country, not more than 1 in 35 die annually. At Rome the inhabitants are numbered every year. In 1771 they were found to amount to 159,675: the average number of deaths for ten years was 7367; which makes 1 in 23 $\frac{1}{2}$ annually. In London not less than 1 in 20 $\frac{1}{2}$ of the inhabitants die every year.

Man.

M. Daubenton has given in the *Encyclopédie Méthodique*, a table of the probabilities of the duration of life, constructed from that which is to be found in the sixteenth volume of the *Supplément à l'Histoire Naturelle de M. de Buffon*.

The following is an abridgment of it:

Of 23,994 children born at the same time, there will probably die,

In one year	-	-	-	7998
Remaining $\frac{1}{2}$ or 15996.				
In eight years	-	-	-	11997
Remaining $\frac{1}{4}$ or 11997.				
In 38 years	-	-	-	15996
Remaining $\frac{1}{8}$ or 7998.				
In 50 years	-	-	-	17994
Remaining $\frac{1}{10}$ or 5998.				
In 61 years	-	-	-	19995
Remaining $\frac{1}{16}$ or 3999.				
In 70 years	-	-	-	21595
Remaining $\frac{1}{20}$ or 2399.				
In 80 years	-	-	-	22395
Remaining $\frac{1}{25}$ or 599.				
In 90 years	-	-	-	23914
Remaining $\frac{1}{100}$ or 79.				
In 100 years	-	-	-	23992
Remaining $\frac{1}{10000}$ or 2.				

It thus appears, that a very small number of men ^{Recapitulation} indeed pass through all the periods of life, and arrive of the ^{different} at the goal marked out by nature. Innumerable causes ^{stages.} accelerate our dissolution. The life of man, we have observed, consists in the activity and exercise of his organs, which grow up and acquire strength during infancy, adolescence, and youth. No sooner has the body attained its utmost perfection, than it begins to decline. Its decay is at first imperceptible; but in the progress of time the membranes become cartilaginous, the cartilages acquire the consistence of bone; the bones become more solid, and all the fibres are hardened. Almost all the fat wastes away; the skin becomes withered and scaly; wrinkles are gradually formed; the hair grows white; the teeth fall out; the face loses its shape; the body is bent; and the colour and consistence of the crystalline humour become more perceptible. The first traces of this decay begin to be perceived at the age of forty, and sometimes sooner; this is the *age of decline*. They increase by slow degrees till sixty, which is the *period of old age*. They increase more rapidly till the age of seventy or seventy-five. At this period *craxiness* begins, and continues always to increase. Next succeeds *decrepitude*, when

Man.

when the memory is gone, the use of the senses lost, the strength totally annihilated, the organs worn out, and the functions of the body almost destroyed. Little now remains to be lost; and before the age of ninety or an hundred, death terminates at once decrepitude and life.

42
Gradual
extinction
of life.

The body then dies by little and little: its motion gradually diminishes; life is extinguished by successive gradations, and death is only the last term in the succession. When the motion of the heart, which continues longest, ceases, man has then breathed his last; he has passed from the state of life to the state of death; and as at his birth a breath opened to him the career of life, so with a breath he finishes his course.

43
Natural
cause of
death.

This natural cause of death is common to all animals and even to vegetables. We may observe that the centre of an oak first perishes and falls into dust, because the parts having become harder and more compact can receive no further nourishment. The causes of our dissolution, therefore, are as necessary as death is inevitable; and it is no more in our power to retard this fatal term than to alter the established laws of the universe. Hence the following maxim has been universally adopted, *Contra vim mortis, nullum medicamentum in homine*. In whatever manner death happens, the time and circumstances thereof are unknown. It is considered, however, as at all times terrible, and the very thoughts of it fill the mind with fear and trouble. It is notwithstanding our duty frequently to direct our thoughts to that event, which must inevitably happen, and by a life of virtue and innocence to prepare against those consequences which we so much dread.

44
Operates
more slowly
upon wo-
men than
upon men.

As in women the bones, the cartilages, the muscles, and every other part of the body, are softer and less solid than those of men, they must require more time in hardening to that degree which occasions death.—Women of course ought to live longer than men. This reasoning is confirmed by experience; for by consulting the bills of mortality, it appears, that after women have passed a certain age they live much longer than men who have arrived at the same age.—In like manner, it is found by experience, that in women the age of youth is shorter and happier than in men, but that the period of old age is longer, and attended with more trouble. *Cilius pubescens, cilius senescens*.

45
Dissolution
of the body.

After death, the organization of the body begins to be dissolved, and all the parts relax, corrupt, and separate. This is produced by an intestine fermentation, which occasions putrefaction, and reduces the body to volatile alkali, fetid oil, and earth.

THE other particulars that were proposed to be noticed in this article are, The several senses with which man is endowed; his constitution, and animal functions; and that variety of colour, form, and character, which he assumes in different quarters of the globe. But there is no occasion to enlarge upon those topics here, as they have been already explained in other parts of the work. For the two first, see *ANATOMY, passim*. The last has been partly discussed under the word *COMPLEXION*, and will be resumed afterwards under the article *VARIETIES of the Human Species*. For what regards man,

considered as a rational, social, moral, and religious being, see *METAPHYSICS, MORAL Philosophy, RELIGION, and THEOLOGY*; also *SOCIETY, LAW, LANGUAGE, and LOGIC*.

Man.

ISLE of MAN, an island in the Irish sea, lying about seven leagues north from Anglesey, about the same distance west from Lancashire, nearly the like distance south-east from Galloway, and nine leagues east from Ireland. Its form is long and narrow, stretching from the north-east of Ayre-point to the Calf of Man, which lies south-west, at least 30 English miles. Its breadth in some places is more than nine miles, in most places eight, and in some not above five, and contains about 160 square miles.

The first author who mentions this island is Cæsar; for there can be as little doubt, that, by the *Mona*, of which he speaks in his Commentaries, placing it in the midst between Britain and Ireland, we are to understand Man; as that the *Mona* of Tacitus, which he acquaints us had a fordable strait between it and the continent, can be applied only to Anglesey. Pliny has set down both islands; *Mona*, by which he intends Anglesey, and *Monabio*, which is Man. In Ptolemy we find *Monaxia*, or *Monaid*, that is, the farther or more remote Min. Orosius styles it *Menavia*; tells us, that it was not extremely fertile; and that this, as well as Ireland, was then possessed by the Scots. Beda, who distinguishes clearly two Menavian islands, names this the northern *Menavia*, bestowing the epithet of *southern* upon Anglesey. In some copies of Nennius, this isle is denominated *Eulonja*; in others, *Menavia*; but both are explained to mean *Man*. Alured of Beverley also speaks of it as one of the Menavian islands. The Britons, in their own language, called it *Manawy*, more properly *Main an*, i. e. “a little island,” which seems to be latinized in the word *Menavia*. All which clearly proves, that this small isle was early inhabited, and as well known to the rest of the world as either Britain or Ireland.

In the close of the first century, the Druids, who were the priests, prophets, and philosophers of the old Britons, were finally expelled by Julius Agricola from the southern *Mona*; and we are told, that they then took shelter in the northern. This island they found well planted with firs; so that they had, in some measure, what they delighted in most, the shelter of trees; but, however, not the shelter of those trees in which they most delighted, viz. the oaks; and therefore these they introduced. No histories tell us this; but we learn it from more certain authority, great woods of fir having been discovered interred in the bowels of the earth, and here and there small groves of oaks; but as these trees are never met with intermixed, so it is plain they never grew together; and as the former are by far the most numerous, we may presume them the natural produce of the country, and that the latter were planted and preserved by the Druids. They gave the people, with whom they lived, and over whom they ruled, a gentle government; wise laws, but withal a very superstitious religion. It is also very likely that they hindered them, as much as they could, from having any correspondence with their neighbours; which is the reason that

Man.

that, though the island is mentioned by so many writers, not one of them, before Orosius, says a word about the inhabitants. A little before his time, that is, in the beginning of the fifth century, the Scots had transported themselves thither; it is said, from Ireland. The tradition of the natives of Man (for they have a traditionary history) begins at this period. They style this first discoverer *Mannan Mac Lear*; and they say that he was a magician, who kept this country covered with mists, so that the inhabitants of other places could never find it. But the ancient chronicles of Ireland inform us, that the true name of this adventurer was *Orlfeinius*, the son of Alladius, a prince in their island; and that he was surnamed *Mannanan*, from his having first entered the island of Man, and *Mac Lir*, i. e. "the offspring of the sea," from his great skill in navigation. He promoted commerce; and is said to have given a good reception to St Patrick, by whom the natives were converted to Christianity.

The princes who ruled after him seem to have been of the same line with the kings of Scotland, with which country they had a great intercourse, assisting its monarchs in their wars, and having the education of their princes confided to them in time of peace.

In the beginning of the seventh century, Edwin king of Northumberland invaded the Menavian islands, ravaged Man, and kept it for some time, when, Bede assures us, there were in it about 300 families; which was less than a third part of the people in Anglesey, though Man wants but a third of the size of that island.

The second line of their princes they derive from Orri, who, they say, was the son of the king of Norway; and that there were 12 princes of this house who governed Man. The old constitution, settled by the Druids, while they swayed the sceptre, was perfectly restored; the country was well cultivated and well peopled; their subjects were equally versed in the exercise of arms and in the knowledge of the arts of peace: in a word, they had a considerable naval force, an extensive commerce, and were a great nation, tho' inhabiting only a little isle. Gutterd the son of Orri built the castle of Ruffyn, A. D. 960, which is a strong place, a large palace, and has subsisted now above 800 years. Macao was the ninth of these kings, and maintained an unsuccessful struggle against Edgar, who reduced all the little sovereigns of the different parts of Britain to own him for their lord; and who, upon the submission of Macao, made him his high-admiral, by which title (*archipirata*, in the Latin of those times) he subscribes that monarch's charter to the abbey of Glastonbury.

After the death of Edward the Confessor, when Harold, who possessed the crown of England, had defeated the Norwegians at the battle of Stamford, there was amongst the fugitives one Goddard Crowman, the son of Harold the Black, of Iceland, who took shelter in the isle of Man. This isle was then governed by another Goddard, who was a descendant from Macao, and he gave him a very kind and friendly reception. Goddard Crowman, during the short stay he made in the island, perceived that his name-like

was universally hated by his subjects; which inspired him with hopes that he might expel the king, and become master of the island. This he at last accomplished, after having defeated and killed Fingal the son of Goddard, who had succeeded his father. Upon this he assigned the north part of the island to the natives, and gave the south to his own people; becoming, in virtue of his conquest, the founder of their third race of princes. However he might acquire his kingdom, he governed it with spirit and prudence; made war with success in Ireland; gained several victories over the Scots in the Isles; and, making a tour through his new-obtained dominions, deceased in the island of Ilay. He left behind him three sons. A civil war breaking out between the two eldest, and both of them deceasing in a few years, Magnus king of Norway coming with a powerful fleet, possessed himself of Man and the isles, and held them as long as he lived; but, being slain in Ireland, the people invited home Olave, the youngest son of Goddard Crowman, who had fled to the court of England, and been very honourably treated by Henry the Second. There were in the whole nine princes of this race, who were all of them feudatories to the kings of England; and often resorted to their court, were very kindly received, and had pensions bestowed upon them. Henry III. in particular, charged Olavo, king of Man, with the defence of the coasts of England and Ireland; and granted him annually for that service 40 marks, 100 measures of wheat, and five pieces of wine. Upon the demise of Magnus, the last king of this isle, without heirs male, Alexander III. king of Scots, who had conquered the other isles, seized likewise upon this; which, as parcel of that kingdom, came into the hands of Edward I. who directed William Huntercumbe, guardian or warden of that isle for him, to restore it to John Baliol, who had done homage to him for the kingdom of Scotland.

But it seems there was still remaining a lady named *Aylfrica*, who claimed this sovereignty, as cousin and nearest of kin to the deceased Magnus. This claimant being able to obtain nothing from John Baliol, applied herself next to king Edward, as the superior lord. He, upon this application, by his writ, which is yet extant, commanded both parties, in order to determine their right, to appear in the king's bench. The progress of this suit does not appear; but we know farther, that this lady, by a deed of gift, conveyed her claim to Sir Simon de Montacute; and, after many disputes, invasions by the Scots, and other accidents, the title was examined in parliament, in the seventh of Edward III. and solemnly adjudged to William de Montacute; to whom, by letters-patent, dated the same year, that monarch released all claim whatsoever.

In the succeeding reign, William Montacute, earl of Salisbury, sold it to Sir William Scroop, afterwards earl of Wiltshire; and, upon his losing his head, it was granted by Henry IV. to Henry Percy, earl of Northumberland; who, being attainted, had, by the grace of that king, all his lands restored, except the isle of Man, which the same monarch granted to Sir John Stanley, to be held by him of the kings his

Man.

Man.

heirs and successors, by homage, and a gift of falcons to be presented at every coronation. Thus it was possessed by this noble family, who were created earls of Derby, till the reign of queen Elizabeth; when, upon the demise of earl Ferdinand, who left three daughters, it was, as lord Coke tells us, adjudged to those ladies, and from them purchased by William earl of Derby, the brother of Ferdinand, from whom it was claimed by descent, and adjudged to its present possessor, his grace the duke of Athol.

This island, from its situation directly in the mouth of the channel, is very beneficial to Britain, by lessening the force of the tides, which would otherwise break with far greater violence than they do at present. It is frequently exposed to very high winds; and at other times to mists, which, however, are not at all unwholesome. The soil towards the north is dry and sandy, of consequence unfertile, but not unimprovable; the mountains, which may include near two-thirds of the island, are bleak and barren; yet afford excellent peat, and contain several kinds of metals. They maintain also a kind of small swine, called *purrs*, which are esteemed excellent pork. In the valleys there is as good pasture, hay, and corn, as in any of the northern counties; and the southern part of the island is as fine soil as can be wished. They have marl and lime-stone sufficient to render even their poorest lands fertile; excellent slate, rag-stone, black marble, and some other kinds for building. They have vegetables of all sorts, and in the utmost perfection; potatoes in immense quantities; and, where proper pains have been taken, they have tolerable fruit. They have also hemp, flax, large crops of oats and barley, and some wheat. Hogs, sheep, goats, black cattle, and horses, they have in plenty; and, though small in size, yet if the country was thoroughly and skillfully cultivated, they might improve the breed of all animals, as experience has shown. They have rabbits and hares very fat and fine; tame and wild fowl in great plenty; and in their high mountains they have one airy of eagles and two of excellent hawks. Their rivulets furnish them with salmon, trout, eels, and other kinds of fresh-water fish; on their coasts are caught cod, turbot, ling, halibut, all sorts of shell-fish (oysters only are scarce, but large and good), and herrings, of which they made anciently a great profit, though this fishery is of late much declined.

The inhabitants of Man, though far from being unmixed, were, perhaps, till within the course of the present century, more so than any other under the dominion of the crown of Great Britain; to which they are very proud of being subjects, though, like the inhabitants of Jersey and Guernsey, they have a constitution of their own, and a peculiarity of manners naturally resulting from a long enjoyment of it.—The Manks tongue is the only one spoken by the common people. It is the old British, mingled with Norse, or the Norwegian language, and the modern language. The clergy preach and read the common prayer in it. In ancient times they were distinguished by their stature, courage, and great skill in maritime affairs. They are at this day a brisk, lively, hardy, industrious, and well-meaning people. Their frugality defends them

from want; and though there are few that abound, there are as few in distress; and those that are, meet with a cheerful unconstrained relief. On the other hand, they are choleric, loquacious, and, as the law till lately was cheap, and unincumbered with solicitors and attorneys, not a little litigious. The revenue, in the earl of Derby's time, amounted to about 2000*l.* a-year; from which, deducting his civil list, which was about 700*l.* the clear income amounted to 1800*l.* At the same time, the number of his subjects was computed at 20,000.—The sovereign of Man, though he has long ago waved the title of *king*, was still invested with regal rights and prerogatives; but the distinct jurisdiction of this little subordinate royalty, being found inconvenient for the purposes of public justice, and for the revenue (it affording a commodious asylum for debtors, outlaws, and smugglers), authority was given to the treasury, by stat. 12 Geo. I. c. 28. to purchase the interest of the then proprietors for the use of the crown; which purchase was at length completed in the year 1765, and confirmed by stat. 5. Geo. III. c. 26. and 39.; whereby the whole island and all its dependencies (except the landed property of the Athol family), their manorial rights and emoluments, and the patronage of the bishopric and other ecclesiastical benefices, are unalienably vested in the crown, and subjected to the regulation of the British excise and customs. The duke, however, is procuring an act of parliament to revise the former one.

The most general division of this island is into north and south; and it contains 17 parishes, of which five are market-towns, the rest villages. Its division with regard to its civil government, is into six shreadings, every one having its proper coroner, who is in the nature of a sheriff, is intrusted with the peace of his district, secures criminals, brings them to justice, &c. The lord chief-justice Coke says, "their laws were such as scarce to be found any where else." In July 1786, a copper coinage for the use of the island was issued from the Tower of London.—There is a ridge of mountains runs almost the length of the isle, from whence they have abundance of good water from the rivulets and springs; and Snafield, the highest, rises about 580 yards. The air is sharp and cold in winter, the frosts short, and the snow, especially near the sea, lies not long on the ground. Here are quarries of good stone, rocks of lime-stone, and red free-stone, and good slate, with some mines of lead, copper, and iron. The trade of this island was very great before the year 1726; but the late lord Derby farming out his customs to foreigners, the insolence of those farmers drew on them the resentment of the government of England, who, by an act of parliament, deprived the inhabitants of an open trade with this kingdom. This naturally introduced a clandestine commerce, which they carried on with England and Ireland with prodigious success, and an immense quantity of foreign goods was run into both kingdoms, till the government in 1765 thought proper to put an entire stop to it, by purchasing the island of the duke of Athol, already mentioned, and permitting a free trade with England. On the little isle of Peel, on the west side of Man, is a town of the same name, with a fortified castle.

Man.

Man.

castle. Before the fourth promontory of Man, is a little island called the *Calf of Man*: it is about three miles in circuit, and separated from Man by a channel about two furlongs broad. At one time of the year it abounds with puffins, and also with a species of ducks and drakes, by the English called *barnacles*, and by the Scots *clakers* and *Soland geese*.

The inhabitants of this isle are of the church of England; and the bishop is styled *Bishop of Sodor and Man*. This bishoprick was first erected by Pope Gregory IV. and for its diocese had this isle and all the Hebrides, or Western islands of Scotland; but which were called *Sodor* by the Danes, who went to them by the north, from the Swedish *Sodor*, *Sail* or *Oar* islands, from which the title of the bishop of Sodor is supposed to originate. The bishop's seat was at Rushin, or Castletown, in the isle of Man, and in Latin is entitled *Sodoræsis*. But when this island became dependent upon the kingdom of England, the Western islands withdrew themselves from the obedience of their bishop, and had a bishop of their own, whom they entitled also *Sodoræsis*, but commonly *Bishop of the Isles*. The patronage of the bishopric was given, together with the island, to the Stanleys by king Edward IV. and came by an heir-female to the family of Athole; and, on a vacancy thereof, they nominated their designed bishop to the king, who dismissed him to the archbishop of York for consecration.—By an act of parliament, the 33d of king Henry VIII. this bishopric is declared in the province of York.

Man-of-war Bird. See *FELICINUS*.

MANAGE. See *MANEAGE*.

MANASSEH (in Scripture hist.), the eldest son of Joseph, and grandson of the patriarch Jacob (Gen. xli. 50, 51.) was born in the year of the world 2293, before Jesus Christ 1714.

The tribe descended from him came out of Egypt, in number 32,200 men, fit for battle, upwards of 20 years old, under the conduct of Gamaliel son of Pedahzur (Numb. ii. 20, 21.) This tribe was divided at their entrance into the land of Promise. One half had its portion beyond the river Jordan, and the other half on this side the river. The half tribe of Manasseh which settled beyond the river-possessed the country of Bashan, from the river Jabbok to mount Libanus, (Numb. xxii. 32, 34, &c.) and the other half tribe of Manasseh on this side Jordan, obtained for its inheritance the country between the tribe of Ephraim to the south, and the tribe of Issachar to the north, having the river Jordan to the east and the Mediterranean sea to the west, (Josh. xvi. xvii.)

MANASSEH, the 15th king of Judah, being the son and successor of Hezekiah. His acts are recorded in 2 Kings xx. xxi. and 2 Chr. xxxiii.

MANATI, in zoology. See *TRIENECTUS*.

MANCA, was a square piece of gold coin, commonly valued at 30 pence; and *mancausa* was as much as a mark of silver, having its name from *manu-cause*, being coined with the hand: (Leg. Canut.) But the *manca* and *mancausa* were not always of that value; for sometimes the former was valued at six shillings, and the latter, as used by the English Saxons, was equal in value to our half-crown. *Manca sex solidis æstimetur*, (Leg. H. i. c. 69.) Thorn, in his chronicle, tells us,

that *mancausa æst pondus duorum solidorum et sex denariorum*; and with him agrees Du Cange, who says, that 20 *manca* make 50 shillings. *Manca* and *mancausa* are promiscuously used in the old books for the same money.

MANCHA, a territory of Spain in the province of New Castile, lying between the river Guadiana and Andalusia. It is a mountainous country; and it was here that the famous Don Quixote was supposed to perform his exploits.

MANCHESTER, a town of Lancashire in England, situated in W. Long. 2. 42. N. Lat. 53. 27.—Mr Whitaker conjectures, that the station was first occupied by the Britons about 500 B. C. but that it first received any thing like the form of a town 450 years after, or 50 B. C. when the Britons of Cheshire made an intrusion into the territories of their southern neighbours, and of consequence alarmed the Sæntuntii, or inhabitants of Lancashire, so much, that they began to build fortresses in order to defend their country. Its British name was *Mancunio*; which was changed by the Romans, who conquered it under Agricola, A. D. 79, into *Mancunium*; from whence comes the present name of *Manchester*.—It is 182 miles from London; and stands near the conflux of the Irk and the Irwell, three miles from the Mersey. It is large, populous, and adorned with many fine buildings and streets. It has a spacious market-place, a college; and an exchange. The suttain manufactory, called *Manchester-cotton*, for which it has been famous for near 200 years, has been much improved of late by some inventions of dyeing and printing, which, with the great variety of other manufactures, called *Manchester goods* (of which they export vast quantities abroad, especially to the West Indies), such as ticking, tapes, filleting, and linen-cloth, enrich the town, and employ men, women, and children. It has two churches, viz. St Mary's and St Anne's. The latter was begun by contribution of the inhabitants, in the reign of Queen Anne, and finished in 1723. The collegiate church, which was built in 1422, is a fine large edifice, with a beautiful choir, and a clock that shows the age of the moon. The three most eminent foundations here are, its college, hospital, and public school. The college was founded in 1421. The king, by act of parliament in 1729, is empowered to be visitor of this college. The hospital was founded by Humphry Cheetham, Esq; and incorporated by Charles II. for the maintenance of 40 poor boys of this town and the neighbouring parishes; but the governors have enlarged the number to 60, to be taken in between six and ten years of age, and maintained, lodged, and clothed, till the age of 14, when they are to be bound apprentices at the charge of the said hospital. The founder also erected a library in it, and settled 116l. a-year on it for ever, to buy books, and to support a librarian. There is a large school for the hospital boys, where they are taught to read, write, &c. The public school was founded anno 1513. Here are three masters, with handsome salaries; and the foundation boys have certain exhibitions for their maintenance at the university. Besides these, there are three charity schools. It stands on a stony hill, where are noble quarries. *Kersal-moor* is noted for horse-

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horse-races. This place, in fine, is deservedly reckoned the greatest village or market-town in England : for though its chief magistrate is only a constable or headborough, yet it is more populous than York, Norwich, or most cities in England, and as big as two or three of the lesser ones put together ; for of the people, including those in the suburbs, there were reckoned not less than 20,000 communicants above 100 years ago, and now the inhabitants are not less than 10,000. Here is a firm old stone-bridge over the Irwell, which is built exceedingly high ; because, as the river comes from the mountainous parts of the country, it rises sometimes four or five yards in one night, but falls next day as suddenly. There are for three miles above the town no less than 60 mills upon it. By the late inland navigation, it has communication with the rivers Mersey, Dee, Ribble, Onfe, Trent, Darwent, Severn, Humber, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles, in the counties of Lincoln, Nottingham, York, Westmoreland, Chester, Stafford, Warwick, Leicester, Oxford, Worcester, &c. The weavers here have looms that work 24 laces at a time, an invention for which they are obliged to the Dutch. The market here is on Saturday ; and the fairs are on Whit-Monday, September 21, and November 6.—It is a manor with courts leet and baron. What is now called *Knock-Castle*, was the seat of the Roman *Castrum* ; and the foundation of the castle wall and ditch still remain in *Castle-Field*, as it is sometimes called.—The market-place, surrounded with old dirty buildings, is called the *Old Town* ; and rents run very high.—Manchester sends no members to parliament, but has the title of a *Duchy*.

MANCHINEEL. See HIPPOMANE.

MANCIPATIO, was a term made use of in the Roman law, and may be thus explained : every father had such a regal authority over his son, that before the son could be released from his subjection and made free, he must be three times over sold and bought, his natural father being the vender. The vendee was called *pater fiduciarius*. After this fictitious bargain, the *pater fiduciarius* sold him again to the natural father, who could then, but not till then, *manumit* or make him free. The imaginary sale was called *mancipatio* ; and the act of giving liberty or setting him free after this was called *emancipatio*.

MANCIPATIO also signifies the selling or alienating of certain lands by the balance, or money paid by weight, and five witnesses. This mode of alienation took place only amongst Roman citizens, and that only in respect to certain estates situated in Italy, which were called *mancipia*.

MANCIPLE (*maniceps*), a clerk of the kitchen, or caterer. An officer in the inner temple was anciently so called, who is now the steward there ; of whom Chaucer, the ancient English poet, some time a student of that house, thus writes :

A manciple there was within the temple,
Of which all caterers might take example.

This officer still remains in colleges in the universities.

MANCUNION, (anc. geog.), a town of the Brigantes in Britain. Now *Manchester* in Lancashire.

MANCUS (formed of *manu cufus*), in antiquity, an Anglo-Saxon gold coin, equal in value to 2 solidi, or 30 pence ; and in weight to 55 Troy grains. The first account of this coin that occurs in the history of our country, is about the close of the 8th century, in an embassy of Cenwulf king of Mercia to Leo III. requesting the restoration of the jurisdiction of the see of Canterbury : this embassy was enforced by a present of 120 mancuses. Ethelwulf also sent yearly to Rome 300 mancuses : and these coins are said to have continued in some form or other till towards the conclusion of the Saxon government. The heriots of the nobility are chiefly estimated by this standard in Canute's laws. It came originally from Italy, where it was called *ducat* : and is supposed to have been the same with the drachma or majariensis current in the Byzantine empire.

MANDAMUS, in law, a writ that issues out of the court of king's-bench, sent to a corporation, commanding them to admit or restore a person to his office. This writ also lies where justices of the peace refuse to admit a person to take the oaths in order to qualify himself for enjoying any post or office ; or where a bishop or archdeacon refuses to grant a probate of a will, to admit an executor to prove it, or to swear a church-warden, &c.

MANDANES, an Indian prince and philosopher, who for the renown of his wisdom was invited by the ambassadors of Alexander the Great to the banquet of the son of Jupiter. A reward was promised him if he obeyed, but he was threatened with punishment in case of a refusal. Unmoved by promises and threatenings, the philosopher dismissed them with observing, that though Alexander ruled over a great part of the universe, he was not the son of Jupiter ; and that he gave himself no trouble about the presents of a man who possessed not therewithal to content himself. " I despise his threats (added he) ; if I live, India is sufficient for my subsistence ; and to me death has no terrors, for it will only be an exchange of old age and infirmity for the happiness of a better life."

MANDARINS, a name given to the magistrates and governors of provinces in China, who are chosen out of the most learned men, and whose government is always at a great distance from the place of their birth.—*Mandarin* is also a name given by the Chinese to the learned language of the country ; for besides the language peculiar to every province, there is one common to all the learned in the empire, which is in China what Latin is in Europe ; this is called the *mandarin tongue*, or the *language of the court*.

MANDATE, in law, a judicial commandment to do something. See the article MANDAMUS.

MANDATE, in the canon law, a rescript of the pope commanding an ordinary collator to put the person therein named in possession of the first vacant benefice in his collation.

MANDATUM, was a fee or retainer given by the Romans to the *procuratores* and *advocati*. The *mandatum* was a necessary condition, without which they had not the liberty of pleading. Thus the legal eloquence of Rome, like that of our own country, could not be unlocked without a golden key.

MANDERSCHUIT, a town of Germany in the circle

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circle of the Lower Rhine, and in the electorate of Trier, capital of a county of the same name, between the diocese of Trier and the duchy of Juliers. E. Long. 6. 32. N. Lat. 50. 20.

MANDEVILLE (Sir John), a physician, famous for his travels, was born at St Alban's, about the beginning of the 14th century. He had a liberal education, and applied himself to the study of physic; but being at length seized with an invincible desire of seeing distant parts of the globe, he left England in 1332, and did not return till 34 years after. His friends, who had long supposed him dead, did not know him when he appeared. He had travelled through almost all the east, and made himself master of a great variety of languages. He particularly visited Scythia, Armenia the Greater and Less, Egypt, Arabia, Syria, Media, Mesopotamia, Persia, Chaldea, Greece, Dalmatia, &c. His rambling disposition did not suffer him to rest; for he left his own country a second time, and died at Liege in the Netherlands in 1372. He wrote An Itinerary, or an Account of his Travels, in English, French, and Latin.

MANDEVILLE (Bernard de), an eminent writer in the 18th century, was born in Holland, where he studied physic, and took the degree of doctor in that faculty. He afterwards came over into England, and in 1714 published a poem, intitled, "the Grumbling Hive, or Knaves turned Honesty;" upon which he afterwards wrote remarks, and published the whole at London, 1720, in 8vo, under the title of, "The Fables of the Bees, or private Vice made public Benefits; with an Essay on Charity and Charity-schools, and a Search into the Nature of Society." This book was presented by the jury of Middlesex in July the same year, and severely animadverted upon in "A Letter to the Right Honourable Lord C." printed in the London Journal of Saturday July 27, 1723. Our author published a Vindication. His book was attacked by several writers. He published other pieces, and died in 1724.

MANDRAGORA, in botany. See ATROPA.

MANDRAKE, in botany. See ATROPA and MUSA.

MANDREL, a kind of wooden pulley, making a member of the turner's lathe. Of these there are several kinds; as *Flat Mandrels*, which have three or more little pegs or points near the verge, and are used for turning flat boards on. *Pin Mandrels*, which have a long wooden shank to fit into a round hole made in the work to be turned. *Hollow Mandrels*, which are hollow of themselves, and used for turning hollow work. *Screw Mandrels*, for turning screws, &c.

MANE, the hair hanging down from a horse's neck; which should be long, thin, and fine; and if frizzled, so much the better.

MANEGE, or MANAGE, the exercise of riding the great horse; or the ground set apart for that purpose; which is sometimes covered, for continuing the exercise in bad weather; and sometimes open, in order to give more liberty and freedom both to the horseman and horse. See HORSEMANSHIP.

The word is borrowed from the French *manage*, and that from the Italian *maneggio*; or, as some will have it, *a manu agendo*, "acting with the hand."

MANES, a poetical term, signifying the shades or souls of the deceased. The heathens used a variety of ceremonies and sacrifices to appease the manes of those who were deprived of burial. See LEMURES and LEMURIA.

Dii MANES, were the same with *inferi*; or the infernal gods, who tormented men; and to these the heathens offered sacrifices to assuage their indignation.

The heathen theology is a little obscure with regard to these gods manes. Some hold, that they were the souls of the dead; others, that they were the geni of men; which last opinion suits best with the etymology of the word.

The heathens, it is pretty evident, used the word *manes* in several senses; so that it sometimes signified the ghosts of the departed, and sometimes the infernal or subterraneous deities, and in general all divinities that presided over tombs.

The evocation of the manes of the dead seems to have been very frequent among the thessalians; but it was expressly prohibited by the Romans. See LARES.

MANES, the founder of the Manichæan system. See MANICHÆUS.

MANETHO, an ancient Egyptian historian, who pretended to take all his accounts from the sacred inscriptions on the pillars of Hermes Trismegistus. He was high priest of Heliopolis in the time of Ptolemy Philadelphus, at whose request he wrote his history in Greek; beginning from their gods, and continuing it down to near the time of Darius Codomanus who was conquered by Alexander the Great. His history of Egypt is a celebrated work, that is often quoted by Josephus and other ancient authors. Julius Africanus gave an abridgment of it in his Chronology. Manetho's work is however lost; and there only remain some fragments extracted from Julius Africanus, which are to be found in Eusebius's Chronica.

MANFREDI (Eustachio), a celebrated mathematician, born at Bologna in 1644, where he was elected mathematical professor in 1688. He was made a member of several academies, and acquired great reputation by his Ephemerides, 4 vols 4to, as well as by other works. He died in 1739.

MANFREDONIA, a port town of Naples, on the Gulph of Venice, which arose on the ruins of the ancient Sipontum; (see the article SIPONTUM). It received its name from its founder *Manfred*; who transplanted hither the few inhabitants that remained at Sipontum; and attracted other settlers to it by various privileges and exemptions. In order to found it under the most favourable auspices, he called together all the famous professors of astrology (a science in which both he and his father placed great confidence), and caused them to calculate the happiest hour and minute for laying the first stone. He himself drew the plans, traced the walls and streets, superintended the works, and by his presence and largesses animated the workmen to finish them in a very short space of time. The port was secured from storms by a pier, the ramparts were built of the most solid materials, and in the great tower was placed a bell of so considerable a volume as to be heard over all the plain of Capitanata, in order to alarm the country in case of

Manes
Manfredonia

Manganese an invasion. Charles of Anjou afterwards removed the bell to Bari, and offered it at the shrine of St Nicholas, as a thanksgiving for the recovery of one of his children. In spite of all the precautions taken by Manfred to secure a brilliant destiny to his new city, neither his pains, nor the horoscopes of his wizards, have been able to render it opulent or powerful. At present, Mr Swinburn informs us, it scarce musters six thousand inhabitants, though most of the corn exported from the province is shipped off here, and a direct trade carried on with Venice and Greece, for which reason there is a lazaretto established; but from some late instances we may gather, that if the kingdom of Naples has for many years past remained free from the plague, it is more owing to good luck, and the very trifling communication with Turkey, than to the vigilance or incorruptibility of the officers of this port. In 1620, the Turks landed and pillaged Manfredonia. All sorts of vegetables abound here, for flavour and succulence infinitely superior to those raised by continual waterings in the ciceritious soil of Naples. Lettuce in particular is delicious, and fish plentiful and cheap.

MANGANESE, or **MAGNESIA NIGRA**, a dark-coloured mineral employed in glass-works for purifying the glass, by taking away the colour it has already, or by superadding a new colour to it. It is also used in the glazing of earthen ware, where it communicates a black colour. From its property of rendering glass colourless, it has sometimes been called the soap of glass.

This substance, commonly called *black or glass-maker's manganese*, is scarcely any other thing than the calx of a new femmetal, whose properties were for the first time investigated by Mr Scheele in the Stockholm Memoirs for 1774: afterwards it was more fully investigated by Dr Gahn, and lately by several other chemists. Its colour is of a dusky white; and the surface is uneven and irregular, owing to its imperfect fusion. It is bright and shining when first broken, but tarnishes by exposure to air much sooner than any other metallic substance. Its specific gravity is 6,850: it equals, if it does not exceed, iron in hardness, as well as difficulty of fusion. When reduced to powder, it becomes magnetical, though large pieces of it are not so. When exposed to the air, it soon crumbles into a blackish brown powder, somewhat heavier than the regulus itself; and this effect is sooner produced in a moist than a dry air.

The regulus is obtained by making the calx or ore of manganese into a ball with pitch, and putting it into a crucible with powdered charcoal one-tenth of an inch thick on the sides and a quarter of an inch at the bottom. The empty space is then to be filled with powdered charcoal, covering the crucible with another. Having luted the joints, the whole is to be exposed to the strongest heat of a forge for an hour or more. This regulus is soluble in all the acids, but most readily in the nitrous, the solution in which is generally of a brownish colour, though that in the others is mostly colourless. The brown colour in the nitrous solution arises from the mixture of a small portion of iron, and there is always a black residuum resembling plumbago left undissolved. Aerated alkalis throw down a white

precipitate from these solutions, which by heat grows **Manganese** black, and is converted into the original calx of the metal.

Regulus of manganese melts readily with other metals, mercury alone excepted. Copper, united with a certain quantity of it, is extremely malleable; but scarce any traces of the red colour are to be seen on the surface when polished, but the mixture sometimes has a green efflorescence by age. Its decomposition by air is very remarkable. A piece of it newly made, when put into a dry bottle well corked, remained perfect for six months; but afterwards, when exposed only for two days to the open air of a chamber, contracted a brown colour on the surface, and became so friable as to crumble into powder between the fingers, the internal parts only retaining an obscure metallic splendour, which also disappeared in a few hours.

This surprising facility of decomposition might naturally lead us to suppose that no such thing as native manganese could exist in the earth. In the *Journal de Physique* for January 1786, however, M. de Peyroulle gives an account of a native regulus of manganese, the properties of which are as follow: 1. In appearance it very much resembles the artificial regulus already mentioned. 2. It dirties the fingers by handling. 3. None of its particles are in the least affected by the magnet. 4. It is composed of laminae having a kind of divergence among themselves. 5. Its metallic brilliancy is the same with that of the artificial regulus, and it has a partial malleability. 6. When repeatedly hammered, it exhibits a kind of exfoliation, forming itself into very thin leaves. 7. Its opacity and density are so completely similar to the artificial regulus, that were it not for the matrix in which the latter is imbedded, it would be in a manner impossible to distinguish them.

This regulus is not found in large masses, or in any solid continuous body, but only in clots or lumps inclosed and intermixed with the powdery or calciform ore. These lumps are somewhat flattened or compressed in their form like the artificial ones, though for the most part they are of a larger size. This powdery magnesian ore, in which the reguline lumps are imbedded, has an argentine hue, as if the materials had been subjected to some violent heat upon the spot.—This regulus was found among the iron mines of *Sem*, in the valley of *Vidorfos*, in the county of Foix, near the Pyrenean mountains.

Manganese is found in a calciform slate, of various colours. M. de Magellan observes, that the aerial acid is the only mineralizer of this femmetal in its dry state; and that in proportion to the different degrees of phlogification, a variety of colours is produced. When it contains as much phlogiston as possible, without being reduced to a regulus, it always appears of a white colour, and contains about 40 per cent. of fixed air. In proportion to its dephlogification and union with other substances, its colour is either blue, green, yellow, red, or black.

The black manganese seems to be the decayed particles of that which is indurated. The latter is met with either pure, or in form of balls seemingly composed of concentric fibres; sometimes, but very rarely, it is met with of a white colour. Cronstedt informs us, that he had a specimen of this from an unknown place

Manganese in Norway. He found that it differed from the common kind by giving a deep red colour to borax in the fire. By calcination it assumes a reddish brown colour.

Blue manganese, according to Mr Scheele, acquires its colour from the phlogiton which it is enabled to retain by its union with fixed alkalis. Green arises from a mixture of the blue with the yellow calx of iron, and the yellow colour, from a prevalence of this calx; red from a slight deplogitization of the calx; and black from a thorough deplogitization of it.—The white kind, above mentioned, contains but a very small proportion of iron. Rinman found it both in small white crystals and in round masses in the cavities of quartz, and adhering to glanz-blende. The hardness rather less than limestone, the texture sparry, and the substance scarcely magnetic even after roasting: it affords a colourless solution with nitrous acid, from which mild alkalis throw down a white precipitate turning black with heat, as already mentioned, of the regulus itself. The white ore has also been found vegetating on the surface of some iron ores, particularly hematites. Mr Rinman also met with it in the form of calcareous spar of the colour of rosin, somewhat shining, and covered over in some places with a footy powder. It is found also in thin pieces, transparent at the edges, but not hard enough to strike fire. This consists of manganese bedded in zeolite. It melts *per se* with the heat of a blow-pipe into a whitish grey porous slag; and with the addition of calcined borax gives a garnet colour to glass. According to Kirwan, many of the white sparry iron ores may be classed among those of manganese, as they contain more of this femimetal than of iron.

Red manganese is said to be found in Piedmont, but Cronstedt says he never saw it. He was told by an ingenious workman, that this variety is free from iron, and gives rather a red than violet colour to glass. Mr Kirwan says, that this kind has less fixed air and more iron than the white kind. It is also joined with ponderous earth, calcareous earth, ponderous spar, and flint. It is found either loose or femindurated, in a matrix of calcareous spar, on talcky schistus, or on hematites or other iron ores. It is found likewise in heavy hard masses of lamellar, radiated, or equable texture, or crystallized in pyramids, rhomboids, or short brittle needles.

Manganese is also met with in a state of union with iron. This is black, with a metallic splendour, and is the kind commonly employed in glass-houses and potteries. There are several varieties of this stone in the mountains round Bath named Mendip-hills, of which the Bristol potters consume great quantities. The black ores of manganese differ but little from the brown ones. They are both found either crystallized as the red ores, or in solid masses, some of which have a metallic appearance; but others are dull, earthy, and mixed, or embodied in quartz, or in a loose earthy form. Their specific gravity is about 4.000. The black manganese is met with either solid and of a sluggy texture, steel-grained, radiated, or crystallized.

The Perigord stone belongs to this species of manganese. It is of a dark grey colour like the basalt, and may be scraped with a knife, but cannot be bro-

ken without difficulty. It is very compact, heavy, and as black, internally, as charcoal. It has a glittering appearance of a striated kind, like the ore of antimony; and its particles are disposed in the form of needles crossing one another without any agglutination, inasmuch that some are loose in a manner similar to iron filings when stuck to a loadstone, and resembling on the whole the scoria from a blacksmith's forge. By calcination this substance assumes a reddish brown colour, and becomes harder, but is not magnetic. It does not melt *per se*, but affords an amethyst-coloured glass with borax. Nitrous acid has little effect upon it without sugar. It seems to contain clay and some iron, and is of considerable specific gravity. It is found in some parts of England as well as in Gascony and Dauphiny in France. The French potters and common enamellers sometimes employ this substance in the glazing of their ware.

Black-wadd is likewise an ore of manganese. It is found in Derbyshire, and is of a dark brown colour, partly in powder, and partly indurated and brittle. If half a pound of it be dried before the fire, and afterwards suffered to cool for an hour, and two ounces of linseed oil afterwards added, mixing the whole loosely like barm with flour, little clots will be formed, and, in something more than half an hour the whole will grow hot, and at last burst into flame. The heat of the room in which this experiment was tried might be about 30° of Fahrenheit, and the heat to which it was exposed in drying about 130. According to Wedgwood's Analysis, this ore contains 43 parts of manganese, as much iron, $4\frac{1}{2}$ of lead, and near 5 of micaceous earth.

Besides the ores mentioned above, Mr Scheele informs us, that he has found manganese existing in potashes. Chemists, he tells us, have often observed, that alkaline salts, when calcined, assume a bluish or greenish colour. The cause of this has been said to be a quantity of phlogiton present in the alkali; but to this he objects, that such a colour is not destroyed by fusion with nitre. When fixed alkali is made to run over the crucible by too strong a fire, the part that attaches itself to the outside acquires a dark-green colour in consequence of the ashes uniting with it. If one part of alkali of tartar be mixed with one-fourth of fine sifted ashes and one-eighth of nitre, a dark-green mass is obtained, which, by solution in water, affords a beautiful green solution, and, when filtered, turns red on the addition of a few drops of vitriolic acid. Some days afterwards a small quantity of brown powder falls to the bottom, which discovers the same chemical properties as manganese. On dissolving a quantity of sifted ashes in muriatic acid by digestion in a sand-heat, the same smell of aqua-regia arises that is perceived on mixing manganese with spirit of salt. Adding some hours afterwards a certain quantity of vitriolic acid, in order to precipitate the greater part of the calcareous earth, the liquor had a yellow colour when filtered, and by means of fixed alkali let fall a yellow precipitate, which by calcination turned of a dark-grey, and showed signs of containing manganese. Hence it appears that manganese really exists in the ashes of vegetables, but not equally in all; for Mr Scheele observes, that wood-ashes contain much more than those of thyme (*thymus serpyllum*).

Manganese

Mr Scheele has laboured exceedingly to decompose this substance, and to discover its component parts. He candidly acknowledges, however, that he did not succeed in this investigation according to his wish, and therefore cannot be certain that his conclusions are altogether just. The following experiments, however, he tells us, were made with the greatest accuracy as well as expence of time and trouble.

Half an ounce of phlogisticated manganese, purified from all foreign particles, was calcined upon an iron-plate till it grew black. It was then dissolved in diluted vitriolic acid, with the addition of a little sugar, in a sand-heat till the solution became limpid. On cooling, a fine shining powder precipitated, which proved to be selenite. Having separated this by filtration, and then diluted the solution with six ounces of distilled water, precipitating it afterwards by vegetable alkali, the powder was elucorated, and again exposed to calcination (A). The manganese, when deprived of its phlogiston, was again dissolved by means of sugar in diluted vitriolic acid; by which means a much selenite was obtained as before. The filtered solution was treated exactly in the same manner, and the operation repeated eleven times, yielding to appearance as much selenite as before. On weighing the results of all these calcinations, the manganese was found to be reduced to three drachms and five grains, and the quantity of selenite had increased to 49 grains; the whole seems therefore to be convertible into calcareous earth. On attempting to invert the experiment, and to produce manganese by combining phlogiston with calcareous earth, he found it impossible to unite the two substances by any means he could devise.

This analysis of manganese was undertaken at the desire of Mr Bergman; who having informed him that Mr Sage supposed manganese to be nothing else than a mineralised mixture of cobalt and zinc, he afterwards made several experiments with a view to detect these substances, but in vain. "Manganese (says Mr Bergman) has been classed by all mineralogists among the ores of iron; but Mr Pott supposed the iron to be only accidentally mixed with it; and at last Mr Cronstedt, in his Essay on Mineralogy, 1758, placed it among the earths. For my part, however, I must own that there are several circumstances which make me think that it is a metallic substance: No pure earth colours glass, but all metallic calces have this property. Manganese, therefore, in this respect, shows a great resemblance to the latter; which is further increased by its specific gravity, and its strong attraction for phlogiston." Having then mentioned its precipitation by the Prussian alkali as an additional proof of its metallic nature, he proceeds thus: "But what kind of metal it is which manganese contains is not so easily ascertained. The solution of cobalt does not lose its colour on adding sugar or any other phlogistic substance, and zinc does not impart any colour to acids. These two substances consequently differ from manganese, which does not indeed entirely agree with any other of the known metallic earths. I have, however, great reason to conjecture that it

must be platina, the earth of which is not yet known; Manganese or a new metal, which at least would agree with platina in the great difficulty with which it fuses."

It has already been observed, that manganese is used in glass-works, and is capable both of destroying the colour of glass, and of giving a new colour to it, viz. that of violet. Mr Scheele deduces its operation from the properties related under the article CHEMISTRY, n° 1359 & seq. He enumerates its effects on glass-fluxes as follows: 1. A colourless glass-flux becomes constantly more or less red on addition of manganese, according to the quantity. 2. If the flux be a little alkaline, the colour will approach to violet. 3. Arsenic, gypsum, and calx of tin, destroy the red colour in these glasses, and thus render them clear. The action of arsenic is easily explained from CHEMISTRY, n° 919, where it is shown that manganese decomposes arsenic by uniting with its phlogiston, and that arsenic itself is composed of an acid of a peculiar nature united with phlogiston. On mixing manganese, therefore, with glass in fusion, the phlogiston of the arsenic unites with the manganese, while the acid of arsenic unites with the alkali of the glass. This experiment succeeds in a covered crucible, though never when gypsum or calx of tin are made use of; but on adding powdered charcoal, an effervescence ensues, the red colour disappears, and the glass becomes colourless. The phlogiston of the charcoal is therefore the cause of the destruction of the colour, and the effervescence is a necessary consequence of the emission of the phlogiston. 4. If glass coloured red by manganese be fused in a crucible with powdered charcoal, the colour disappears during the effervescence without the addition of gypsum or calx of tin; but on keeping the glass a long time in fusion upon charcoal, by means of the blow-pipe, the colour does not disappear. Nay, if the colourless glass be kept in this state for a short time upon charcoal, it grows red again. 5. By adding a little sulphur, the colour disappears; and the same thing takes place on the addition of any metallic calx or any neutral salt containing the vitriolic acid. But here it must be observed, that all metals whose calces colour glass, while they deprive it of that which it has received from the manganese, will not fail to communicate their own peculiar colour to it. If to such a colourless glass-globule, nitre, even in the smallest quantity, be added, it presently grows red again; and the same thing happens if such a colourless glass-globule be kept in fusion for a few minutes upon an iron plate; and thus the red colour may be made to appear and disappear as often as we please.

From this explanation it appears how manganese purifies glass. When the colour of it depends on a quantity of coaly matter, it is improper to add more than is just sufficient to saturate the phlogiston. With regard to the green colour of common bottle-glass, Mr Scheele made the following experiment to determine whether it proceeded from iron or not. Having melted green glass by the blow-pipe upon a piece of the same substance, left in using a crucible he should have been deceived by the iron it contained, he poured

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(A) As in this process a quantity of fixed air is always expelled from the alkali, it was necessary, in order to prevent any of the manganese from being dissolved by it, to place the whole for some hours upon hot sand, to expel the aerial fluid.

Manganeſe upon it a large quantity of muriatic acid; and having extracted a tincture, and poured into it a few drops of the ſolution of Pruffian alkali, it aſſumed a bluifh colour. Hence he concludes, that iron, nearly in its metallic form, is preſent in common green glaſs; for its calx always gives a yellowiſh colour to glaſs, and manganefe added to a ſolution of iron in acids deſtroys the green colour, ſubſtituting a yellow one in its room; and in like manner, nitre added to green glaſs in fuſion takes away its colour. The ſame effect is produced by manganefe if added in proper quantity; though, according to the experiments of Mr Scheele, ſomewhat of a yellowiſh colour ought to have been communicated by it; and he is of opinion that it was really ſo, though the quantity of iron was too ſmall to render it diſtinctly viſible. It is alſo remarkable, that the rays of light paſſing through glaſs of this kind, when nearly red hot, appear of a yellowiſh colour.

Mr Engellſtrom's experiments on this ſubject are ſomewhat different from thoſe of Mr Scheele. Having melted manganefe and borax together upon a piece of charcoal, the glaſs at firſt aſſumed the common colour of manganefe; but this was repeatedly deſtroyed, and made to appear without adding any thing. During the operation he took notice of the following phenomena: 1. When a ſmall quantity of manganefe was taken, the colour was light, but with a larger it became nearly black; and whatever colour it aſſumed on the firſt fuſion was maniſeſted alſo at the ſecond, when it was made to reappear. 2. Manganefe, on being melted with borax, efferveſces violently; which ceases, however, as ſoon as the manganefe is diſſolved. 3. To make the colour of the glaſs diſappear, it was neceſſary only to direct the blue flame of the candle upon the glaſs, and that equally and conſtantly, but not very violently. On blowing more faintly, and allowing the brown flame to touch the place, the colour returned. 4. About the time that the glaſs becomes colourleſs, a kind of ſecſion or partition is obſerved in it; and as ſoon as the colour diſappears, the blowing muſt be immediately diſcontinued, ſo that the brown flame ſhall not afterwards touch the glaſs. When it is taken out with the forceps, it appears perfectly colourleſs. 5. This deſtruction of the colour ſeems not to happen ſuddenly, but by degrees; for when the blowing was now and then diſcontinued before the true mark had appeared, the glaſs was generally lighter than before, though not quite colourleſs.

Though our author had been able to diſcharge the colour thus from glaſs, and to make it reappear, it ſeemed doubtful whether this could be done frequently; for having blown the blue flame violently againſt ſome glaſs, the colour of which he had already twice diſcharged and made to reappear, he found that it could not again be diſcharged even by conſtant blowing for an hour. In another experiment, having added a large quantity of manganefe, he found that the glaſs retained its colour even in the utmoſt heat he could give it, though it always became colourleſs when warm, but regained its colour in the cold.

In both theſe experiments the violence of the flame had diſperſed and driven off ſome ſmall globules, which always remained colourleſs: the reaſon of this he thinks is, that manganefe, or its colouring part, has a ſtrong attraction for a ſmall part only of borax; and

that, by means of a violent heat, the ſuperfluous part may be ſeparated, and the reſt unite more cloſely with the earthy particles. The ſame thing happened likewiſe with the ſmall globules, which ſometimes remained after the maſs was taken away, fixed to the charcoal by the violence of the flame. "If this is really the caſe (ſays he), it would follow, that by repeating the experiment ſome of theſe particles would always ſeparate if a ſufficiently ſtrong flame was applied, and it would be impoſſible to expel the red colour afterwards. I dare not, however, advance this conjecture, though it is grounded on ſome experiments as a matter of certainty."

Cronſtedt obſerves, that manganefe communicates a colour both to glaſſes and ſaline ſolutions. Borax, which has diſſolved it, becomes transparent, and aſſumes a reddiſh brown or hyacinthine colour; the microſcopic ſalt becomes transparent, of a crimſon colour, and moulders in the air. In compoſitions for glaſs it becomes violet with the fixed alkali; but if a great quantity of manganefe be added, the glaſs is in thick lumps and looks black; by ſcorification with lead the glaſs obtains a reddiſh brown colour. Manganefe deſagregates with nitre; and the reſiduum, when thus deſagregated, communicates a deep-red colour to its lixivium. The calx, when reckoned to be light, weighs as much as an iron ore of the ſame texture. It ferments with vitreous compoſitions, and fill more when melted with the microſcopic ſalt. The colours communicated by manganefe to glaſſes are eaſily deſtroyed by the calx of tin or aſenic, and likewiſe vaſiſh of themſelves in the air.

According to Dr Brunnich, manganefe, when melted with nitre, aſſumes a green colour. Tin unites very readily with manganefe; but zinc not without great difficulty, perhaps on account of its volatility and inflammable nature. White aſenic adheres to it, and, by means of the phlogiſton, reduces it to a metallic form. By ſimple calcination a blackiſh powder is produced; but if the ignition be continued for twelve days, it acquires a dark-green colour; producing alſo, ſometimes, one of a white or reddiſh colour. All theſe various calces, by means of a ſufficient degree of heat in a common crucible, run into a yellowiſh-red glaſs, which is pellucid, unleſs from too great thickneſs.

MANGE, in dogs. See *Diseases of Dogs*.

MANGE, in ſcurvy. See there, § xxiii.

MANGEART (Dom Thomas), a Benedicteine of the congregation of St Vanne and St Hidulphe, whoſe knowledge was an ornament to his order. It gained him alſo the titles of antiquarian, librarian, and counſellor, to Charles duke of Lorrain. He was preparing a very conſiderable work when he died, A.D. 1763, before he had put his laſt hand to his book, which was publiſhed by Abbé Jacquin. This production appeared in 1763, in folio, with this title: *Introduction à la ſcience des Medailles, pour ſervir à la connoiſſance des Dieux, de la Religion, des Sciences, des Arts, et de tout ce qui appartient à l'Histoire ancienne, avec les preuves tirées des Medailles*. The elementary treatiſes on the numiſmatic ſcience were not ſufficiently extenſive, and the particular diſſertations were by far too tedious and prolix. This learned Benedicteine has collected into a ſingle volume all the principles contained in the former, and all the ideas of any conſequence which

Mangel
||
Mangifera.

which are to be found scattered through the latter. His work may serve as a supplement to Montfaucon's *Antiquity explained*. From Mangelart we likewise have a volume of sermons; and a treatise on Purgatory, Nancy, 1739, 2 vols 12mo.

MANGEL-WURZEL. See BETA; and AGRICULTURE, n° 52.

A MANGER, is a raised trough under the rack in the stall, made for receiving the grain or corn that a horse eats.

MANGER, a small apartment, extending athwart the lower-deck of a ship of war, immediately within the haule-holes, and fenced on the after-part by a partition, which separates it from the other part of the deck behind it. This partition serves as a fence to interrupt the passage of the water, which occasionally gushes in at the haule-holes, or falls from the wet cable whilst it is heaved in by the cap'n. The water, thus prevented from running aft, is immediately returned into the sea by several small channels, called *scuppers*, cut through the ship's side within the manger. The manger is therefore particularly useful in giving a contrary direction to the water that enters at the haule-holes, which would otherwise run aft in great streams upon the lower-deck, and render it extremely wet and uncomfortable, particularly in tempestuous weather, to the men who mels and sleep in different parts thereof.

MANGENOT (Lewis), a canon of the temple at Paris, where he was born A. D. 1694, and died in 1768 at the age of 74. He was a social poet, and an amiable man. But although lively and agreeable in his conversation, his character leaned somewhat towards cynical misanthropy. Of this we may judge from the following verses, written on a little parlour which he had erected in a garden dependent on his benedict.

*Sont inquietude, sans peine,
Je jouis dans ces lieux du destin le plus beau;
Les Vieux m'ont accordé l'Amor de Diogene,
Et mes folâtres talens m'ont valu son tannour.*

His Poems were published at Amsterdam in 1776. This collection contains two eclogues full of nature, simplicity, and elegance; fables, some of which are well composed; tales, which are by far too licentious; moral reflections; sentences; madrigals, &c. &c.

MANGET (John-James), an eminent physician, born at Geneva in 1652. The elector of Brandenburg made him his first physician in 1699; in which post he continued till his death, which happened at Geneva in 1742. He wrote many works; the most known of which are, 1. A collection of several Pharmacopœias, in folio. 2. *Bibliotheca pharmaceutico-medica*. 3. *Bibliotheca anatomica*. 4. *Bibliotheca chemica*. 5. *Bibliotheca chirurgica*. 6. A *Bibliotheca* of all the authors who have written on medicine, in 4 vols folio. All these works are in Latin. Daniel le Clerc, the author of a History of Physic, assisted him in writing them.

MANGIFERA, the MANGO-TREE, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking with those of which the order is doubtful. The corolla is pentapetalous; the plum kidney-shaped. There is but one species, a native of many parts of the East Indies, whence it has been transplanted to Brazil and other warm parts of America. It

grows to a large size; the wood is brittle, the bark rough when old; the leaves are seven or eight inches long, and more than two inches broad. The flowers are produced in loose panicles at the ends of the branches, and are succeeded by large oblong kidney-shaped plums. This fruit, when fully ripe, is greatly esteemed in the countries where it grows; but in Europe we have only the unripe fruit brought over in pickle. All attempts to propagate the plant have hitherto proved ineffectual; and Mr Miller is of opinion that the stones will not vegetate unless they are planted soon after they are ripe. He thinks therefore that the young plants ought to be brought over in boxes of earth; after which they may be kept in the tan-bed of the stove.

MANGOSTAN, or MANGOSTEEN. See GARCINIA.

MANGROVE. See RHIZOPHORA.

MANHEIM, a town of Germany, in the Lower Palatinate, with a very strong citadel, and a palace, where the elector Palatine often resides. It is seated at the confluence of the rivers Neckar and Rhine, in E. Long. 8. 33. N. Lat. 49. 25.

MANHOOD, that stage of life which succeeds puberty or adolescence. See MAN, n° 23.

MANIA, or MADNESS. See MEDICINE-INDEX.

MANICHEES, or MANICHEANS (*Manichei*), a sect of ancient heretics, who asserted two principles; so called from their author *Manes* or *Manicheus*, a Persian by nation, and educated among the magi, being himself one of that number before he embraced Christianity.

This heresy had its first rise about the year 277, and spread itself principally in Arabia, Egypt, and Africa. St Epiphanius, who treats of it at large, observes, that the true name of this heresiarch was Curbicus; and that he changed it for *Manes*, which in the Persian or Babylonish language signifies *veffel*. A rich widow, whose servant he had been, dying without issue, left him store of wealth; after which he assumed the title of the *apostle* or *envoy* of Jesus Christ.

Manes was not contented with the quality of apostle of Jesus Christ, but he also assumed that of the Paraclete, whom Christ had promised to send: which Augustin explains, by saying, that Manes endeavoured to persuade men, that the Holy Ghost did personally dwell in him with full authority. He left several disciples, and among others Addas, Thomas, and Hermas. These he sent in his lifetime into several provinces to preach his doctrine. Manes, having undertaken to cure the king of Persia's son, and not succeeding, was put in prison upon the young prince's death, whence he made his escape; but he was apprehended soon after, and slayed alive.

However, the oriental writers, cited by D'Herbelot and Hyde, tell us, that Manes, after having been protected in a singular manner by Hormizdas, who succeeded Sapor in the Persian throne, but who was not able to defend him, at length, against the united hatred of the Christians, the Magi, the Jews, and the Pagans, was shut up in a strong castle, to serve him as a refuge against those who persecuted him on account of his doctrine. They add, that after the death of Hormizdas, Varanes I. his successor, first protected Manes, but afterwards gave him up to the fury of the Magi, whose resentment against him was due to his having

Manichees. having adopted the Sadducean principles, as some say; while others attribute it to his having mingled the tenets of the Magi with the doctrines of Christianity. However, it is certain that the Manicheans celebrated the day of their master's death. It has been a subject of much controversy whether Manes was an impostor. The learned Dr Lardner has examined the arguments on both sides; and though he does not choose to deny that he was an impostor, he does not discern evident proofs of it. He acknowledges, that he was an arrogant philosopher and a great schemist; but whether he was an impostor, he cannot certainly say. He was much too fond of philosophical notions, which he endeavoured to bring into religion, for which he is to be blamed: nevertheless, he observes, that every bold dogmatist is not an impostor.

The doctrine of Manes was a motley mixture of the tenets of Christianity with the ancient philosophy of the Persians, in which he had been instructed during his youth. He combined these two systems, and applied and accommodated to Jesus Christ the characters and actions which the Persians attributed to the god Mithras.

He established two principles, *viz.* a good and an evil one: the first, a most pure and subtle matter, which he called *light*, did nothing but good; and the second a gross and corrupt substance, which he called *darkness*, nothing but evil. This philosophy is very ancient; and Plutarch treats of it at large in his *Isis and Osiris*.

Our souls, according to Manes, were made by the good principle, and our bodies by the evil one; those two principles being, according to him, coeternal, and independent of each other. Each of these is subject to the dominion of a superintending being, whose existence is from all eternity. The being who presides over the *light* is called *God*: he that rules the land of *darkness* bears the title of *hyle* or *demon*. The ruler of the *light* is supremely happy, and in consequence thereof benevolent and good: the prince of *darkness* is unhappy in himself, and desirous of rendering others partakers of his misery, and is evil and malignant. These two beings have produced an immense multitude of creatures, resembling themselves, and distributed them through their respective provinces. After a contest between the ruler of *light* and the prince of *darkness*, in which the latter was defeated, this prince of *darkness* produced the first parents of the human race. The beings engendered from this original stock, consist of a body formed out of the corrupt matter of the kingdom of darkness, and of two souls; one of which is sensitive and lustful, and owes its existence to the evil principle; the other rational and immortal, a partake of that divine light which had been carried away in the contest by the army of darkness, and immersed into the mass of malignant matter. The earth was created by God out of this corrupt mass of matter, in order to be a dwelling for the human race, that their captive souls might by degrees be delivered from their corporeal prisons, and the celestial elements extended from the gross substance in which they were involved. With this view God produced two beings from his own substance, *viz.* Christ and the Holy Ghost: for the Manicheans held a consubstantial Trinity. Christ, or the glorious intelligence, called by the Persians

Mithras, subsisting in and by himself, and residing in the sun, appeared in due time among the Jews, clothed with the shadowy form of a human body, to disengage the rational soul from the corrupt body, and to conquer the violence of malignant matter. The Jews, incited by the prince of darkness, put him to an ignominious death, which he suffered not in reality, but only in appearance, and according to the opinion of men. When the purposes of Christ were accomplished, he returned to his throne in the sun, appointing apostles to propagate his religion, and leaving his followers the promise of the Paraclete or Comforter, who is Manes the Persian. Those souls who believe Jesus Christ to be the son of God, renounce the worship of the god of the Jews, who is the prince of darkness, and obey the laws delivered by Christ, and illustrated by Manes the comforter, are gradually purified from the contagion of matter; and their purification being completed, after having passed through two states of trial, by water and fire, first in the moon and then in the sun, their bodies return to the original mass (for the Manicheans denied the resurrection of bodies), and their souls ascend to the regions of light. But the souls of those who have neglected the salutary work of purification, pass after death into the bodies of other animals or natures, where they remain till they have accomplished their probation. Some, however, more perverse and obstinate, are consigned to a feverish course of trial, being delivered over for a time to the power of malignant aerial spirits, who torment them in various ways. After this, a fire shall break forth and consume the frame of the world; and the prince and powers of darkness shall return to their primitive seats of anguish and misery, in which they shall dwell for ever. These mansions shall be surrounded by an invincible guard, to prevent their ever renewing a war in the regions of light.

Manes borrowed many things from the ancient Gnostics; on which account many authors consider the Manicheans as a branch of the Gnostics.

In truth, the Manichean doctrine was a system of philosophy rather than of religion. They made use of amulets, in imitation of the Basilidians; and are said to have made profession of astronomy and astrology. They denied that Jesus Christ, who was only God, assumed a true human body, and maintained it was only imaginary: and therefore they denied his incarnation, death, &c. They pretended that the law of Moses did not come from God, or the good principle, but from the evil one; and that for this reason it was abrogated. They rejected almost all the sacred books in which Christians look for the sublime truths of their holy religion. They affirmed, that the Old Testament was not the work of God, but of the prince of darkness, who was substituted by the Jews in the place of the true God. They abstained entirely from eating the flesh of any animal; following herein the doctrine of the ancient Pythagoreans: they also condemned marriage. The rest of their errors may be seen in St Epiphanius and St Augustin; which last, having been of their sect, may be presumed to have been thoroughly acquainted with them.

Tho' the Manichees professed to receive the books of the New Testament, yet in effect they only took so much of them as suited with their own opinions.

They

They first formed to themselves a certain idea or scheme of Christianity; and to this adjusted the writings of the apostles, pretending that whatever was inconsistent with this had been foisted into the New Testament by later writers, who were half Jews. On the other hand, they made fables and apocryphal books *pass* for apostolical writings; and even are suspected to have forged several others, the better to maintain their errors. St Epiphanius gives a catalogue of several pieces published by Manes, and adds extracts out of some of them. These are the *Myteries*, Chapters, Gospel, and Treasury.

The rule of life and manners which Manes prescribed to his followers was most extravagantly rigorous and severe. However, he divided his disciples into two classes; one of which comprehended the perfect Christians, under the name of the *elect*; and the other, the imperfect and feeble, under the title of *auditors* or *hearers*. The elect were obliged to a rigorous and entire abstinence from flesh, eggs, milk, fish, wine, all intoxicating drink, wedlock, and all amorous gratifications; and to live in a state of the severest penury, nourishing their emaciated bodies with bread, herb, pulse, and melons, and depriving themselves of all the comforts that arise from the moderate indulgence of natural passions, and also from a variety of innocent and agreeable pursuits. The auditors were allowed to possess houses, lands, and wealth, to feed on flesh, to enter into the bonds of conjugal tenderness; but this liberty was granted them with many limitations, and under the strictest conditions of moderation and temperance. The general assembly of the Manichees was headed by a president, who represented Jesus Christ. There were joined to him 12 rulers or masters, who were designed to represent the 12 apostles, and these were followed by 72 bishops, the images of the 72 disciples of our Lord. These bishops had presbyters or deacons under them, and all the members of these religious orders were chosen out of the class of the elect. Their worship was simple and plain; and consisted of prayers, reading the scriptures, and hearing public discourses, at which both the auditors and elect were allowed to be present. They also observed the Christian appointment of baptism and the eucharist. They kept the Lord's day, observing it as a fast; and they likewise kept Easter and Pentecost.

Towards the 4th century, the Manichees concealed themselves under various names, which they successively adopted, and changed in proportion as they were discovered by them. Thus they assumed the names of Encratites, Apotactics, Saccophori, Hydroparastates, Solitaries, and several others, under which they lay concealed for a certain time, but could not however long escape the vigilance of their enemies. About the close of the 6th century, this sect gained a very considerable influence, particularly among the Persians.

Toward the middle of the 12th century, the sect of Manichees took a new face, on occasion of one Constantine, an Armenian, and an adherer to it; who took upon him to suppress the reading of all other books besides the Evangelists and the Epistles of St Paul, which he explained in such a manner as to make them contain a new system of Manicheism. He entirely discarded all the writings of his predecessors;

rejecting the chimeras of the Valentinians, and their 30 æons; the fable of Manes, with regard to the origin of rain and other dreams; but still retained the impurities of Basilides. In this manner he reformed Manicheism, inasmuch that his followers made no scruple of anathematizing Scythian, Buddas, called also *Addas* and *Terebinth*, the contemporaries and disciples, as some say, and, according to others, the predecessors and masters of Manes, and even Manes himself, Constantine being now their great apostle. After he had seduced an infinite number of people, he was at last slain by order of the emperor.

This sect prevailed in Bosnia and the adjacent provinces about the close of the 15th century; propagated their doctrines with confidence, and held their religious assemblies with impunity.

MANICORDON, or MANICORD, a musical instrument in form of a spinet; the strings of which, like those of the clavicord, are covered with little pieces of cloth, to deaden as well as to soften their sound, whence it is also called the *dumb spinet*.

MANIFESTO; a public declaration made by a prince in writing, showing his intentions to begin a war or other enterprise, with the motives that induce him to it, and the reasons on which he founds his rights and pretensions.

MANIHOT, or MANIOC. See JATROPHA.

MANILA, LUCONIA, or LUZON, the name of the largest of the Philippine islands in the East Indies, subject to Spain. It had the name of *Luzon* from a custom that prevailed among the natives of beating or bruising their rice in wooden mortars, before they either boiled or baked it; *luzon*, in their language, signifying "a mortar."

As to situation, it is remarkably happy, lying between the eastern and western continents, and having China on the north, at the distance of about 60 leagues; the islands of Japan on the north-east, at the distance of about 250 leagues from the nearest of them; the ocean on the east; the other islands on the south; and on the west Malacca, Patana, Siam, Cambodia, Cochinchina, and other provinces of India, the nearest at the distance of 300 leagues.

The middle of this island is in the latitude 15° north; the east point in $13^{\circ} 38'$, and the most northern point in 19° . The shape of it is said to resemble that of an arm bent; the whole length being about 160 Spanish leagues, the greatest breadth between 30 and 40, and the circumference about 350. As to the longitude, the charts differ, some making the middle of the island to lie 113° east from London, and others in 160° . The climate is hot and moist. One thing is held very extraordinary, that in stormy weather there is much lightning and rain, and that thunder is seldom heard till this is over. During the months of June, July, August, and part of September, the west and south winds blow, which they call *vendavales*, bringing such rains and storms, that the fields are all overflown, and they are forced to have little boats to go from one place to another. From October till the middle of December, the north wind prevails; and from that time till May, the east and south-east; which winds are there called *breezes*. Thus there are two seasons in those seas, by the Portuguese called *monsoons*; whence our word *monsoons*, that is, the breezes half

Manila. half the year, with a serene dry air; and the vendavals the other half, wet and stormy. It is further to be observed, that in this climate no vermin breed upon Europeans, though they wear dirty shirts, whereas it is otherwise with the Indians. The days here being always of an equal length, and the weather never cold, neither their clothes, nor the hour of dining, supping, doing business, studying, or praying, are ever changed; nor is cloth worn, but only against the rain.

The air here being, as has been observed, very hot and moist, is not wholesome; but is worse for young men that come from Europe than for the old. As for the natives, without using many precautions, they live very commonly to fourscore or 100. The soil is so rich, that rice grows even on the tops of the mountains without being watered; and this makes it so plentiful, that the Indians value gold so little as not to pick it up, though it lies almost every where under their feet.

Among the disadvantages of the island, besides frequent and terrible earthquakes, here are several burning mountains. The face of the island, however, is far from being disfigured by them, or by the consequences of their explosions.

The mountaineers, called *Tingiani*, have no particular place of abode, but always live under the shelter of trees, which serve them instead of houses, and furnish them with food; and when the fruit is eaten up, they remove where there is a fresh fort.

Here are 40 different forts of palm-trees, the most excellent cocoas, wild cinnamon, wild nutmegs, and some say wild cloves also; ebony; sandal-wood; the best cassia, and in such plenty, that they feed their hogs with its fruit; all kinds of cattle, and prodigious quantities of gold, amber, and ambergris.

There are several forts of people in this island besides the Spaniards, as the Tagalians or Tagalezes, the Pintadoes or painted negroes, the Ilayas or Tinglianos, and the Negrellos. The Tagalians, who are thought to be Malayans by descent, are a modest, tractable, and well disposed people. The Pintadoes, or painted negroes, are tall, straight, strong, active, and of an excellent disposition. The Tinglianos, whom some suppose to be descended from the Japanese, are very brave, yet very courteous and humane. They live entirely on the gifts of nature; and never sleep under any other shade than that of the trees or a cave. The Negrellos, who are held to be the Aborigines of the island, are barbarous and brutal to the last degree. When they kill a Spaniard, they make a cup of his skull and drink out of it.

This island is divided into several provinces, containing divers towns, the chief of which are Manila, Caceres, New-Segovia, Bondo, Passacao, Ibalon, Bulaw, Serfocan, or Bagatao, Lampoon, Fernandina, Bolinao, Playahonda, Cavite, Mindora, Caleleya, and Balayan.

MANILA, the capital of an island of the same name in the East Indies, on the south-east side of the island, where a large river falls into the sea, and forms a noble bay 30 leagues in compass, to which the Spaniards have given the name of *Bahia*, because the river runs out of the great lake Bahi, which lies at the distance of six leagues behind it. In compass it is two miles,

in length one third of a mile; the shape irregular, being narrow at both ends, and wide in the middle. On the south it is washed by the sea, and on the north and east by the river; being also strongly fortified with walls, ballions, forts, and batteries.—Manila contains about 30,000 souls, who are a very motley race, distinguished by several strange names, and produced by the conjunction of Spaniards, Chinese, Malabars, Blacks, and others inhabiting the city and islands depending on it. Without the walls are large suburbs, particularly that inhabited by the Chinese merchants, called *Sangleys*. In proportion to the size of the place, the number of churches and religious houses is very great. Only small vessels can come up to Manila; but three leagues south of it is the town and port of Cavite, defended by the castle of St Philip, and capable of receiving the largest ships. Here stands the arsenal where the galleons are built, for which there are from 300 to 600 or 800 men constantly employed, who are relieved every month, and while upon duty are maintained at the king's expence. By an earthquake which happened here in 1645, a third part of the city of Manila was destroyed, and no less than 3000 people perished in the ruins.

In the war before last, Spain having entered into engagements with France, in consequence of the family-compact of the house of Bourbon, it was found expedient by Britain to declare war also against Spain. Whereupon a force was sent out from our East-India settlements, particularly Madras, for the conquest of the Philippine Islands, under General Draper and Admiral Cornish: who, after a siege of 12 days, took Manila on the 6th of October 1762 by storm; but, to save so fine a city from destruction, agreed to accept a ransom, amounting to a million sterling, a part of which, it is said, was never paid. The Spanish viceroy resides in this city, and lives like a sovereign prince. The government is said to be one of the best in the gift of the king of Spain. When the city was taken, as above, the archbishop, who is a kind of pope in this part of the world, was also viceroy. Five large ships, loaded with the riches of the East, as diamonds from Golconda, cinnamon from Ceylon, pepper from Sumatra and Java, cloves and nutmegs from the Moluccas and Banda islands, camphire from Bornoe, benjamin and ivory from Cambodia, silks, tea, and china-ware from China, &c. sail yearly from hence to Acapulco in Mexico, and return freighted with silver, making 400 per cent. profit.

The city of Manila is governed by two alcaldes: the rest of the cities and great towns have each an alcalde; and in every village there is a corregidore. Appeals from their sentences are made to the royal court at Manila, in which there are four judges, and a fiscal or attorney-general; each of these judges has a salary of 3300 pieces of eight per annum. The viceroys are president; and in that quality has an income of 4000 pieces of eight, but he has no vote; yet if the judges are equally divided, the president names a doctor of the civil law, who, in virtue of his appointment, has a decisive voice. The attorney-general, in right of his office, is protector of the Chinese, in consideration of which he receives 600 pieces of eight every year. As for the Indians that are in subjection, they pay tribute in the following proportions: Young men from

Manila.

Manilius 18, and from thence, if they continue single, to the age of 60, pay five rials of plate by way of capitation; as single women likewise do from 24 to 50: married men pay ten rials. It is computed, that there are within the compass of this government 250,000 Indians, subject to his Catholic majesty, of whom two-fifths hold immediately from the king, and the rest from lords or proprietors, who pay two rials each for the maintenance of the forces, and the like sum for the parish-priest. The royal revenue is computed at about half a million of pieces of eight, exclusive of casualties. In regard to the military establishment, the garrison of Manila consists of about 800 or 1000 men, and there are about 3000 more in the Philippines. The viceroy is by his office captain-general, with a salary of about 4000 pieces of eight.

MANILIUS (Marcus), a Latin poet, whose poem had the ill luck to lie buried in some German libraries, and was not heard of in the world until Poggius, about two centuries ago, published him from some old manuscripts he found there. There is no account to be found of him but what can be drawn from his poem, which is called *Astronomicum*; and contains a system of the ancient astronomy and astrology, together with the philosophy of the Stoics. It consists of five books; though there was a sixth, which has not been recovered. From the style, and no mention of the author being found in ancient writers, it is probable he died young. It is collected, however, that he was a Roman of illustrious extraction, and lived under the reign of Augustus, whom he invokes, though not by name, yet by circumstances and character that suit no other emperor. The best editions of Manilius are, that of Joseph Scaliger in 1600, and that of Bently at London in 1738.

MANILLE, in commerce, a large brass ring in the form of a bracelet, either plain or engraved, flat or round.

Manilles are the principal commodities which the Europeans carry to the coast of Africa, and exchange with the natives for slaves. These people wear them as ornaments on the small of the leg, and on the thick part of the arm above the elbow. The great men wear manilles of gold and silver; but these are made in the country by the natives themselves.

MANIOC, or **MANIHOT**. See **JATROPHA**.

MANIPULUS, **MANIPULE**, among the Romans, was a little body of infantry, which in the time of Romulus consisted of 100 men; and in the time of the consuls, and first Cæsars, of 200.

The word properly signifies "a handful;" and, according to some authors, was first given to the handful of hay which they bore at the end of a pole, to distinguish themselves by, before the custom was introduced of bearing an eagle for their ensign; and hence also the phrase, *a handful of men*. But Vegetius, Modestus, and Varro, gave other etymologies of the word: the last derives it from *manus*, a little body of men following the same standard. According to the former, this corps was called *manipulus*, because they fought hand in hand or all together: *Contubernium autem manipulus vocabatur ab eo, quod conjunctis manibus pariter dimicabant*.

Each manipule had two centurions, or captains, N° 194.

called *manipularii*, to command it; one whereof was **Manipulus** lieutenant to the other. Each cohort was divided into three manipules, and each manipule into two centuries.

Aulus Gellius quotes an old author, one Cincius, who lived in the time of Hannibal (whose prisoner he was), and who, writing on the art of war, observes, that then each legion consisted of 60 centuries, of 30 manipules, and of ten cohorts. And again, Varro and Vegetius mention it as the least division in the army, only consisting of the tenth part of a century; and Spartan adds, that it contained no more than ten men. It shows that the manipulus was not always the same thing.

MANIPULUS is also an ecclesiastical ornament, worn by the priests, deacons, and subdeacons in the Romish church. It consists of a little fillet in form of a stole, three or four inches broad, and made of the same stuff with the chasuble; signifying and representing an handkerchief which the priests in the primitive church wore on the arm to wipe off the tears they were continually shedding for the sins of the people. There still remains a mark of this usage in a prayer rehearsed by those who wear it; *Merear, Domine, portare manipulum fletus & doloris*.—The Greeks and Maronites wear two manipules, one on each arm.

MANIPULUS, among physicians, is used to signify a handful of herbs or leaves, or so much as a man can grasp in his hand at once; which quantity is frequently denoted by the abbreviation, *M*, or *m*.

MANIS, the **SCALY LIZARD**, in zoology; a genus of quadrupeds belonging to the order of bruta, the characters of which are these: They have no foreteeth either in the upper or under jaw; the tongue is long and cylindrical; the snout is long and narrow; and the body is covered with hard scales. There are two species: 1. the pentadactyla, or short-tailed manis, with five toes on each foot. The head is smaller than the neck; the eyes are very small; the length of the body, including the tail, is from six to eight feet. The whole body is covered with hard scales, excepting the under-part of the head and neck, the breast, the belly, and the internal side of each leg. Betwixt the scales of this animal there are some hairs like the bristles of a hog, brownish at the points. The scales are of a reddish colour, very hard, convex above, and concave below. All the parts which want scales are naked. The scales are unconnected; and the animal can raise or lower them at pleasure, like the quills of the porcupine. When irritated, he erects his scales, and rolls himself up like a hedge-hog. In this situation, neither the lion, tiger, nor any other animal can hurt him. It is said to destroy the elephant by twisting itself round his trunk, and compressing that tender organ with its hard scales. It feeds on lizards and insects; turns up the ground with its nose; walks with its claws bent under its feet; grows very fat; and is esteemed delicate eating; makes no other noise than a kind of snorting. It is a mild inoffensive creature, slow of motion, and has no other method of escaping the pursuit of man, but by concealing himself in crannies of rocks, and in holes which they dig in the ground, and where they likewise bring forth their young. It is a native of the East Indies, and is very rare. Mr Pennant conjectures that it may be a native

Plate
CCLXXIX.

Manley,
Manlius

Manna.

of Guinea; the *quageli* of the Negroes, which, Des Marchais says, grows to the length of eight feet, of which the tail is four. It lives in woods and marshy places; feeds on ants, which it takes by laying its long tongue across their paths, which is covered with a viscid saliva, so that the insects which attempt to pass over it cannot extricate themselves.

2. The tetradactyla, or long-tailed manis, with four toes on each foot. This species is very similar to the former; only the tail of it is much longer in proportion to the body; and such parts as want scales, instead of being naked, are covered with a soft hair. It inhabits Guinea, and is also found in the East Indies.

MANLEY (Mrs), the celebrated writer of the *Atalantis*, was the daughter of Sir Roger Manley, the reputed author of the first volume of the *Turkish Spy*. She lost her parents very early; and after having been deluded into a false marriage by her guardian, who was her cousin, and afterwards deserted her, she was patronized by the duchess of Cleveland, mistress of Charles II. But the duchess, being a woman of a very sickle temper, grew tired of Mrs Manley in six months time; and discharged her upon a pretence, whether groundless or not is uncertain, that she intrigued with her son. After this she wrote her first tragedy, called *Royal Mischiefs*, which was acted with great applause in 1696; and her apartment being frequented by men of wit and gaiety, she soon engaged in amours, and was taken into keeping. Her pen now grew as licentious as her conduct: for, in her retired hours, she wrote four volumes, called *Memoirs of the New Atalantis*; in which she was not only very free in her wanton tales of love-adventures, but satirized the characters of many distinguished persons, especially those who had a principal concern in the Revolution. A prosecution was commenced against her for this work; but whether those in power were ashamed to bring a woman to trial for a few amorous trifles, or whether the laws could not reach her disguised satire, she was discharged; and a total change of the ministry ensuing, Mrs Manley lived in high reputation and gaiety, amusing herself with the conversation of wits, and writing plays, poems, and letters. She died in 1724.

MANLIUS (Capitolinus), the renowned Roman consul and general, who saved the capitol when it was attacked by the Gauls in the night: he was alarmed by the cries of geese, which were ever after held sacred. But being afterwards accused of aspiring at the sovereignty, he was thrown from the Tarpeian rock. See GAUL and ROME.

MANLIUS (Torquatus), a celebrated consul and Roman captain; had great wit, but a difficulty in expressing himself, which induced Manlius Imperiosus, his father, to keep him almost by force in the country. Pompey, tribune of the people, enraged at this instance of severity, formed a design of accusing Manlius the father before the judges; but Torquatus being informed of it, went to that tribune, and, with a poniard in his hand, made him swear that he would not proceed in that accusation against him to whom he owed his life. At length Torquatus was made military tribune, and killed a soldier of the Gauls in single

combat, from whom he took a gold chain that he wore about his neck. From this action he obtained the name of *Torquatus*. He was consul in the war against the Latins; when he ordered his own son to be beheaded, for fighting contrary to his orders, though he had gained the victory. He conquered the enemies of the republic, and was several times made consul; but at last refused the consulship, saying, That it was no more possible for him to bear with the vices of the people, than it was for the people to bear with his severity.

MANNA, in the materia medica, the juice of certain trees of the ash-kind*, either naturally concreted on the plants, or exsiccated and purified by art. There are several sorts of manna in the shops. The larger pieces, called *flake manna*, are usually preferred; though the smaller grains are equally good, provided they are white, or of a pale yellow colour; very light, of a sweet, not unpleasant taste, and free from any visible impurities. Some people injudiciously prefer the fat honey-like manna to the foregoing; this has either been exposed to a moist air, or damaged by sea or other water. This kind of manna is said to be sometimes counterfeited by a composition of sugar and honey mixed with a little scammony; there is also a fictitious manna, which is white and dry, said to be composed of sugar, manna, and some purgative ingredient, boiled to a proper consistence. This may be distinguished by its weight, solidity, untransparent whiteness, and by its taste, which is different from that of manna.

Manna is a mild, agreeable laxative; and may be given with safety to children and pregnant women: nevertheless, in some particular constitutions, it acts very unkindly, producing flatulencies and distensions of the viscera: these inconveniences may be prevented by the addition of any grateful warm aromatic. It operates so weakly, that it does not produce the full effect of a cathartic, unless taken in large doses; and hence it is rarely given in this intention by itself. It may be commodiously dissolved in the purging mineral waters, or joined to the cathartic salts, senna, rhubarb, or the like. Geoffroy recommends acuating it with a few grains of emetic tartar: by this management, he says, bilious serum will be plentifully evacuated, without any nausea, gripes, or other inconvenience. It is remarkable, that the efficacy of this drug is greatly promoted (if the account of Vallinieri is to be relied on) by a substance which is itself very flow of operation, viz. casia. See CASIA.

MANNA, is also a Scripture-term, signifying a miraculous kind of food which fell from heaven for the support of the Israelites in their passage through the wilderness, being in form of coriander-seeds, its colour like that of bellum, and its taste like honey.

The Scripture gives to manna the name of the *bread of heaven*, and the *food of angels*, Psa. lxxviii. 25. whether it would insinuate to us, that the angels sent and prepared this food, or that angels themselves, if they had need of any food, could not have any that was more agreeable than manna was. The author of the Book of Wisdom says, xvi. 20. 21. that manna so accommodated itself to every one's taste, that every one found it pleasing to him; and that it included every thing that was agreeable to the palate and fit for good nourish-

*See MANNA-Trees below.

Manna nourishment; which expression some have taken in the literal sense, though others understand them figuratively.

The critics are divided about the original of the word *manna*. Some think that *man* is put instead of the Hebrew word *mab*, which signifies "What is this?" and that the Hebrews, then first seeing that new food which God had sent them, cried to one another, *man-hu*, instead of *mab-hu*, "What is this?" Others maintain, that the Hebrews very well knew before what manna was; and that, seeing it in great abundance about their camp, they said one to another, *Man-hu*, "This is manna." Mr Saumaïse and some other moderns are of this last opinion. They imagine, that the manna which God sent the Israelites was nothing else but that fat and thick dew which still falls in Arabia, which presently condensed, and served for food to the people; that this is the same thing as the wild honey, mentioned Matt. iii. 4. wherewith John the Baptist was fed; and that the miracle of Moses did not consist in the production of any new substance, but in the exact and uniform manner in which the manna was dispensed by Providence for the maintenance of such a great multitude.

On the contrary, the Hebrews and Orientals believe, that the fall of the manna was wholly miraculous. The Arabians call it the *sugar-plums of the Almighty*; and the Jews are so jealous of this miracle, that they pronounce a curse against all such as presume to deny the interposition of a miraculous power.

Our translation, and some others, make Moses fall into a plain contradiction in relating this story of the manna, which they render thus: "And when the children of Israel saw it, they said one to another, It is manna; for they wist not what it was." Exodus xvi. 15. Whereas the Septuagint, and several authors both ancient and modern, have translated the text according to the original, "The Israelites seeing this, said one to another, What is this? for they knew not what it was." For we must observe, that the word by which they asked, *what this is?* was in their language *man*, which signifies likewise meat ready provided; and therefore it was always afterwards called *man* or *manna*.

Whether this manna had those extraordinary qualities in it or no, which some imagine, it must be allowed to be truly miraculous, upon the following accounts. 1. That it fell but six days in the week. 2. That it fell in such a prodigious quantity, as sustained almost three millions of souls. 3. That there fell a double quantity every Friday, to serve them for the next day, which was their Sabbath. 4. That what was gathered on the first five days stunk and bred worms if kept above one day: but that which was gathered on Friday kept sweet for two days. And, lastly, That it continued falling while the Israelites abode in the wilderness, but ceased as soon as they came out of it and had got corn to eat in the land of Canaan.

† See *Eran*.
1222.

MANNA-Tree, is a species of the ash †, and a native of Calabria in Italy. The shoots of this tree are much shorter, and the joints closer together, than those of the common ash; the small leaves are shorter, and deeper sawed on their edges, and are of a lighter

green. The flowers come out from the side of the branches, which are of a purple colour, and appear in the spring before the leaves come out. This tree is of humble growth, seldom rising more than 15 or 16 feet high in this country.

A great quantity of fine manna is gathered at Carini in Sicily, oozing from a kind of ash-tree with a bark similar to that of the ebony, and a leaf somewhat like the acacia. M. de Non*, who gives an account of this manna, says, that it is produced from young trees about seven or eight years old when they are only about eight feet high. Incisions are then made horizontally in the bark, and from these the manna flows. The incisions are made from the earth to the top of the tree, and are repeated every two days from the end of July till the circulation is stopped in the course of the year, or till the manna becomes worse in quality. It exudes first as a white frothy liquor extremely light, pleasant to the taste, and of an agreeable flavour, which is coagulated by the heat of the sun, and assumes an appearance somewhat resembling stalactites. This is the best kind, and by the people of that country is called *lachrymatory* or *cane manna*. The inferior kind appears first in the form of a glutinous and higher coloured liquor, which is received on the leaves of the Indian fig, which are placed for that purpose at the foot of the tree. This also congeals by the heat of the sun; though it is more heavy, purgative, and of much less value, than the former. It is called *fat manna*: In this part only resides the faint and disagreeable flavour observable in manna; for the cane manna is of an agreeable flavour, and of an excellent stomachic. It is got off from the bark of the tree by bending and shaking it. In rainy seasons, they must gather the manna every day, which both lessens the quantity and renders it of inferior quality. When the stem of the tree is entirely covered with incisions, they cut it down close to the ground; after which it pushes out new tufts of wood, one or two stems of which are preserved, and at a proper age produce manna as before. The tree itself is propagated by seed, and afterwards transplanting it. The wood is hard and heavy, of a bitter taste, and recommended in the dropsy. It thrives only in hot climates, and requires to be exposed to the north winds in order to make it productive; but M. de Non is of opinion, that it might be propagated, and would produce manna in Provence in France. The Sicilian manna is dearer and more esteemed than that of Calabria, though the latter is more generally known and cultivated. The tree does not grow in any other part of the island excepting about Carini, where it is a native.

MANNER, in painting, a habitude that a man acquires in the three principal parts of painting, the management of colours, lights, and shadows; which is either good or bad according as the painter has practised more or less after the truth, with judgment and study. But the best painter is he who has no manner at all. The good or bad choice he makes is called *gout*.

MANNERS, the plural noun, has various significations; as, the general way of life, the morals, or the habits, of any person or people; also ceremonious behaviour, or studied civility. See the next article.

Good.

Manna
||
Manners.

Travel
Sicily.

Good-Manners.

Good-MANNERS, according to Swift, is the art of making those people easy with whom we converse.

Whoever makes the fewest persons uneasy, is the best bred in the company.

As the best law is founded upon reason, so are the best manners. And as some lawyers have introduced unreasonable things into common law; so likewise many teachers have introduced absurd things into common good-manners.

One principal point of this art is to suit our behaviour to the three several degrees of men; our superiours, our equals, and those below us.

For instance, to press either of the two former to eat or drink is a breach of manners; but a tradesman or a farmer must be thus treated, or else it will be difficult to persuade them that they are welcome.

Pride, ill-nature, and want of sense, are the three great sources of ill-manners: without some one of these defects, no man will behave himself ill for want of experience; or of what, in the language of fools, is called *knowing the world*.

"I defy (proceeds our author) any one to assign an incident wherein reason will not direct us what we are to say or to do in company, if we are not misled by pride or ill-nature. Therefore, I insist that good sense is the principal foundation of good manners; but because the former is a gift which very few among mankind are possessed of, therefore all the civilized nations of the world have agreed upon fixing some rules for common behaviour, best suited to their general customs, or fancies, as a kind of artificial good-sense to supply the defects of reason. Without which, the gentlemanly part of dunces would be perpetually at cuffs, as they seldom fail when they happen to be drunk, or engaged in squabbles about women or play. And, God be thanked, there hardly happeneth a duel in a year, which may not be imputed to one of those three motives. Upon which account, I should be exceedingly sorry to find the legislature make any new laws against the practice of duelling; because the methods are easy, and many, for a wife man to avoid a quarrel with honour, or engage in it with innocence. And I can discover no political evil, in suffering bullies, sharpers, and rakes, to rid the world of each other by a method of their own, where the law hath not been able to find an expedient.

"As the common forms of good-manners were intended for regulating the conduct of those who have weak understandings; so they have been corrupted by the persons for whose use they were contrived. For these people have fallen into a needless and endless way of multiplying ceremonies, which have been extremely troublesome to those who practise them, and insupportable to every body else; inasmuch that wife men are often more uneasy at the over-civility of these refinements, than they could possibly be in the conversations of peasants or mechanics.

"The impertinencies of this ceremonial behaviour are nowhere better seen than at those tables where ladies preside, who value themselves upon account of their good-breeding; where a man must reckon upon passing an hour without doing any one thing he hath a mind to, unless he will be so hardy as to break through all the settled decorum of the family. She determines what he loveth best, and how much he shall eat; and

Good-Manners.

if the master of the house happeneth to be of the same disposition, he proceedeth in the same tyrannical manner to prescribe in the drinking part: at the same time you are under the necessity of answering a thousand apologies for your entertainment. And although a good deal of this humour is pretty well worn off among many people of the best fashion, yet too much of it still remaineth, especially in the country; where an honest gentleman assured me, that having been kept four days against his will at a friend's house, with all the circumstances of hiding his boots, locking up the stable, and other contrivances of the like nature, he could not remember, from the moment he came into the house to the moment he left it, any one thing wherein his inclination was not directly contradicted; as if the whole family had entered into a combination to torment him.

"But, besides all this, it would be endless to recount the many foolish and ridiculous accidents I have observed among these unfortunate proselytes to ceremony. I have seen a duchess fairly knocked down by the precipitancy of an officious coxcomb running to save her the trouble of opening a door. I remember, upon a birth-day at court, a great lady was rendered utterly disconsolate, by a dish of sauce let fall by a page directly upon her head-dress and brocade, while she gave a sudden turn to her elbow upon some point of ceremony with the person who sat next her. Monsieur Buys, the Dutch envoy, whose politics and manners were much of a size, brought a son with him about 13 years old to a great table at court. The boy and his father, whatever they put on their plates, they first offered round in order, to every person in the company; so that we could not get a minute's quiet during the whole dinner. At last their two plates happened to encounter, and with so much violence, that, being china, they broke in 25 pieces, and stained half the company with wet sweatmeats and cream.

"There is a pedantry in manners as in all arts and sciences, and sometimes in trades. Pedantry is properly the over-rating any kind of knowledge we pretend to. And if that kind of knowledge be a trifle in itself, the pedantry is the greater. For which reason I look upon fiddlers, dancing-masters, heralds, masters of the ceremony, &c. to be greater pedants than Lipsius, or the elder Scaliger. With these kind of pedants, the court, while I knew it, was always plentifully stocked: I mean from the gentleman-usher (at least) inclusive, downward to the gentleman porter; who are, generally speaking, the most insignificant race of people that this island can afford, and with the smallest tincture of good-manners, which is the only trade they profess. For being wholly illiterate, conversing chiefly with each other, they reduce the whole system of breeding within the forms and circles of their several offices: and as they are below the notice of ministers, they live and die in court under all revolutions, with great obsequiousness to those who are in any degree of credit or favour, and with rudeness and insolence to every body else. From whence I have long concluded, that good-manners are not a plant of the court-growth: for if they were, those people who have understandings directly of a level for such acquirements, and who have served such long apprenticeships to nothing else, would certainly have picked them up. For as to the

Good-
Manners.

great officers who attend the prince's person or councils, or preside in his family, they are a transient body, who have no better a title to good-manners than their neighbours, nor will probably have recourse to gentlemen-ushers for instruction. So that I know little to be learned at court on this head, except in the material circumstance of dress; wherein the authority of the maids of honour must indeed be allowed to be almost equal to that of a favourite actress.

"I remember a passage my lord Bolinbroke told me: That going to receive prince Eugene of Savoy at his landing, in order to conduct him immediately to the queen, the prince said he was much concerned that he could not see her majesty that night: for Monsieur Hoffman (who was then by) had assured his highness, that he could not be admitted into her presence with a tied-up periwig; that his equipage was not arrived; and that he had endeavoured in vain to borrow a long one among all his valets and pages. My lord turned the matter to a jest, and brought the prince to her majesty: for which he was highly censured by the whole tribe of gentlemen-ushers; among whom Monsieur Hoffman, an old dull resident of the emperor's, had picked up this material point of ceremony; and which, I believe, was the best lesson he had learned in 25 years residence.

"I make a difference between *good-manners* and *good-breeding*; although, in order to vary my expression, I am sometimes forced to confound them. By the first, I only understand the art of remembering, and applying, certain settled forms of general behaviour. But *good-breeding* is of a much larger extent: for besides an uncommon degree of literature sufficient to qualify a gentleman for reading a play, or a political pamphlet, it taketh in a great compass of knowledge; no less than that of dancing, fighting, gaming, making the circle of Italy, riding the great horse, and speaking French; not to mention some other secondary or subaltern accomplishments, which are more easily acquired. So that the difference between good-breeding and good-manners lieth in this, That the former cannot be attained to by the best understandings without study and labour; whereas a tolerable degree of reason will instruct us in every part of good-manners without other assistance.

"I can think of nothing more useful upon this subject, than to point out some particulars wherein the very essentials of good-manners are concerned, the neglect or perverting of which doth very much disturb the good commerce of the world, by introducing a traffic of a mutual uneasiness in most companies.

"First, a necessary part of good-manners is a punctual observance of time at our own dwellings, or those of others, or at third places; whether upon matters of civility, business, or diversion; which rule, though it be a plain dictate of common reason, yet the greatest minister I ever knew, was the greatest trespasser against it; by which all his business doubled upon him, and placed him in a continual arrear. Upon which I often used to rally him as deficient in point of good-manners. I have known more than one ambassador, and secretary of state, with a very moderate portion of intellectuals, execute their office with great success and applause, by the mere force of exactness and regula-

Manmory, Manœuvre.
rity. If you duly observe time for the service of another, it doubles the obligation; if upon your own account, it would be manifest folly, as well as ingratitude, to neglect it; if both are concerned, to make your equal or inferior attend on you to his own disadvantage, is pride and injustice.

"Ignorance of forms cannot properly be styled *ill-manners*; because forms are subject to frequent changes; and consequently, being not founded upon reason, are beneath a wife man's regard. Besides, they vary in every country; and after a short period of time vary frequently in the same: so that a man, who travelleth, must needs be at first a stranger to them in every court through which he passeth; and perhaps, at his return, as much a stranger in his own; and, after all, they are easier to be remembered or forgotten than faces or names.

"Indeed, among the many impertinencies that superficial young men bring with them from abroad, this bigotry of forms is one of the principal, and more predominant than the rest; who look upon them not only as if they were matters capable of admitting of choice, but even as points of importance; and therefore are zealous upon all occasions to introduce and propagate the new forms and fashions they have brought back with them: so that, usually speaking, the worst-bred person in the company is a young traveller just arrived from abroad."

MANNORY (Lewis), late advocate of the parliament of Paris, where he was born in 1696, and died in 1777. From him we have 18 vols 12mo of *Pleadings and Memoirs*. A great number of singular cases occur in this collection: and the author has the talent of rendering them more striking by the agreeable manner in which they are stated. He was Travenol's counsel in his process against Voltaire, and was very satirical against that poet. The latter took revenge by describing him as a mercenary babbler, who sold his pen and his abuse to the highest bidder.—Whatever may be the case, Mannory would certainly have been more esteemed both as an advocate and as a writer, if he had paid more attention to his style, and had been less prolix; if he had thought more deeply, and been more sparing of his pleasantries in causes where nothing was required but knowledge and sound reasoning. He published also a translation into French of Father Parcé's funeral Oration on Louis XIV. and very judicious Observations on the Semiramis of Voltaire. In company Mannory was full of wit and spirit, but sometimes a little too cutting and severe.

MANOEUVRE, in a military sense, consists solely in distributing equal motion to every part of a body of troops, to enable the whole to form, or change their position, in the most expeditious and best method, to answer the purposes required of a battalion, brigade, or line, of cavalry, artillery, or infantry. It has always been lamented, that men have been brought on service without being informed of the uses of the different manœuvres they have been practising; and, having no ideas of any thing but the uniformity of the parade, instantly fall into disorder and confusion when they lose the step, or see a deviation from the straight lines they have been accustomed to at exercise. It is a pity to see so much attention given to show, and so little to instruct the troops in what may be of use to

§ Harley
earl of Ox-
ford, lord
high trea-
surer to
Queen
Anne.

Manometer.

to them in real service. No manœuvre should be executed in presence of the enemy, unless protected by some division of the troops.

MANOMETER, or MANOSCOPE, an instrument to show or measure the alterations in the rarity or density of the air. The manometer differs from the barometer in this, That the latter only serves to measure the *weight* of the atmosphere, or of the column of air over it; but the former, the density of the air in which it is found; which density depends not only on the weight of the atmosphere, but also on the action of heat and cold, &c. Authors, however, generally confound the two together; and Mr Boyle himself gives us a very good manometer of his contrivance, under the name of a *statical barometer*, consisting of a bubble of thin glass, about the size of an orange, which, being counterpoised when the air was in a mean state of density, by means of a nice pair of scales, sunk when the atmosphere became lighter, and rose as it grew heavier.

Another kind of manometers were made use of by colonel Roy, in his attempts to correct the errors of the barometer, and are described in the Philosophical Transactions, Vol. LXVII. p. 689. "They were (says he) of various lengths, from four to upwards of eight feet: they consisted of straight tubes, whose bores were commonly from $\frac{1}{4}$ th to $\frac{1}{2}$ th of an inch in diameter. The capacity of the tube was carefully measured, by making a column of quicksilver, about three or four inches in length, move along it from one end to the other. These spaces were severally marked, with a fine-edged file, on the tubes; and transferred from them to long slips of pasteboard, for the subsequent construction of the scales respectively belonging to each. The bulb, attached to one end of the manometer at the glass-house, was of the form of a pear, whose point being occasionally opened, dry or moist air could be readily admitted, and the bulb sealed again, without any sensible alteration in its capacity.

"The air was confined by means of a column of quicksilver, long or short, and with the bulb downward or upwards, according to the nature of the proposed experiment. Here it must be observed, that, from the adhesion of the quicksilver to the tube, the instrument will not act truly, except it be in a vertical position; and even then it is necessary to give it a small degree of motion, to bring the quicksilver into its true place; where it will remain in equilibrio, between the exterior pressure of the atmosphere on one side, and the interior elastic force of the confined air on the other.

"Pounded ice and water were used to fix a freezing point on the tube; and by means of salt and ice, the air was further condensed, generally four, and sometimes five or six degrees below zero. The thermometer and manometer were then placed in a tin vessel among water, which was brought into violent ebullition; where having remained a sufficient time, and motion being given to the manometer, a boiling point was marked thereon. After this the fire was removed, and the gradual descents of the piece of quicksilver, corresponding to every 20 degrees of temperature in the thermometer, were successively marked on a deal rod applied to the manometer. It is to be observed, that both instruments, while in the water,

were in circumstances perfectly similar; that is to say, the ball and bulb were at the bottom of the vessel.

"In order to be certain that no air had escaped by the side of the quicksilver during the operation, the manometer was frequently placed a second time in melting ice. If the barometer had not altered between the beginning and end of the experiment, the quicksilver always became stationary at or near the first mark. If any sudden change had taken place in the weight of the atmosphere during that interval, the same was noted, and allowance made for it in afterwards proportioning the spaces.

"Long tubes, with bores truly cylindrical, or of any uniform figure, are scarcely ever met with. Such however as were used in these experiments; generally tapered in a pretty regular manner from one end to the other. When the bulb was downwards, and the tube narrowed that way, the column of quicksilver confining the air lengthened in the lower-half of the scale, and augmented the pressure above the mean. In the upper half, the column being shortened, the pressure was diminished below the mean. In this case, the observed spaces both ways from the centre were diminished in the inverse ratio of the heights of the barometer at each space, compared with its mean height. If the bore widened towards the bulb when downwards, the observed spaces, each way from the centre, were augmented in the same inverse ratio; but in the experiments on air less dense than the atmosphere, the bulb being upwards, the same equation was applied with contrary signs: and if any extraordinary irregularity took place in the tube, the corresponding spaces were proportioned both ways from that point, whether high or low, that answered to the mean.

"The observed and equated manometrical spaces being thus laid down on the pasteboard containing the measures of the tube; the 212° of the thermometer, in exact proportion to the sections of the bore, were constructed along-side of them: hence the coincidences with each other were easily seen; and the number of thermometrical degrees answering to each manometrical space readily transferred into a table prepared for the purpose."

MANOR, MANERIUM, (*à manendo*, because the usual residence of the owner), seems to have been a district of ground held by lords or great personages; who kept in their own hands so much land as was necessary for the use of their families, which were called *terra dominicales*, or *demesne lands*; being occupied by the lord, or *dominus manerii*, and his servants. The other, or *tenemental* lands, they distributed among their tenants; which, from the different modes of tenure, were called and distinguished by two different names.—First, *book-land*, or charter-land, which was held by deed under certain rents and free services, and in effect differed nothing from free socage lands: and from hence have arisen most of the freehold tenants who hold of particular manors, and owe suit and service to the same. The other species was called *folk-land*, which was held by no assurance in writing, but distributed among the common folk or people at the pleasure of the lord, and resumed at his discretion; being indeed land held in villenage. See VILLENAGE.

The residue of the manor, being uncultivated, was termed

Manometer, Manor.

Blackst. Comments

Manor,
Mans

termed the *lord's waste*, and served for public roads, and for common of pasture to the lord and his tenants. Manors were formerly called *baronies*, as they still are *lordships*; and each lord or baron was empowered to hold a domestic court, called the *court-baron*, for redressing misdemeanors and nuisances within the manor, and for settling disputes of property among the tenants. This court is an inseparable ingredient of every manor; and if the number of suitors should so fail, as not to leave sufficient to make a jury or homage, that is, two tenants at the least, the manor itself is lost.

In the early times of our legal constitution, the king's greater barons, who had a large extent of territory held under the crown, granted out frequently smaller manors to inferior persons to be held of themselves; which do therefore now continue to be held under a superior lord, who is called in such cases the *lord paramount* over all these manors; and his feignory is frequently termed an *honour*, not a *manor*; especially if it hath belonged to an ancient feudal baron, or hath been at any time in the hands of the crown. In imitation whereof, these inferior lords began to carve out and grant to others still more minute estates, to be held as of themselves, and were so proceeding downwards in *infinitum*, till the superior lords observed, that, by this method of subinfeudation, they lost all their feudal profits of wardships, marriages, and escheats, which fell into the hands of these mesne or middle lords, who were the immediate superiors of the *tenants*, or him who occupied the land; and also that the mesne lords themselves were so impoverished thereby, that they were disabled from performing their services to their own superiors. This occasioned, first, that provision in the 32d chapter of *magna charta*, 9 Hen. III. (which is not to be found in the first chapter granted by that prince, nor in the great charter of King John), that no man should either give or sell his land without reserving sufficient to answer the demands of his lord; and, afterwards, the statute of Westm. 3. or *quia emptores*, 18 Edw. I. c. 1. which directs, that, upon all sales, or feoffments of land, the feoffee shall hold the same, not of his immediate feoffor, but of the chief lord of the fee, of whom such feoffor himself held it. But these provisions not extending to the king's own tenants *in capite*, the like law concerning them is declared by the statutes of *prærogativa regis*, 17 Edw. II. c. 6. and of 34 Edw. III. c. 15. by which last all subinfeudations, previous to the reign of king Edward I. were confirmed; but all subsequent to that period were left open to the king's prerogative. And from hence it is clear, that all manors existing at this day, must have existed as early as king Edward the First: for it is essential to a manor, that there be tenants who hold of the lord; and, by the operation of these statutes, no tenant *in capite* since the accession of that prince, and no tenant of a common lord since the statute of *quia emptores*, could create any new tenants to hold of himself. See *VILLENAGE*.

MANS, an ancient, rich, and populous town of France, capital of the county of Maine, with a bishop's see. Its wax and fluffs are famous. It is seated on a high hill near the river Sarr, in E. Long. o. 10. N. Lat. 47. 58. It is an earldom bestowed on William Mur-

ray, chief justice of England, with remainder to the family of Stormont in Scotland.

MANSE, MANsus, *Manſa*, or *Manſum*; in ancient law-books, denotes an *house*, or habitation, either with or without land. See *HOUSE*, and *MANSION*. The word is formed a *manendo*, "abiding;" as being the place of dwelling or residence.

Capital Mansus, (*Manſum Capitale*), denotes the *manor-house*, or lord's court. See *MANOR*.

MANSUS *Presbyteri*, is a parsonage or vicarage house for the incumbent to reside in. This was originally, and still remains, an essential part of the endowment of a parish-church, together with the glebe and tythes. It is sometimes called *Presbyterium*. See *PRESBYTERY*.

MANSFELD, a city of Germany, and capital of a county of the same name, in the circle of Upper Saxony. E. Long. 12. 55. N. Lat. 51. 35.

MANSFELD (Peter Ernest, count of), was descended from one of the most illustrious families in Germany, and which has produced the greatest number of distinguished characters. In 1552, he was taken prisoner at Ivoy, where he commanded; and he was afterwards of great service to the Catholics at the battle of Montcontour. In consequence of his great talents, he was employed in affairs of the utmost delicacy and importance. Being made governor of Luxembourg, he maintained tranquillity in that province, while the rest of the Low Countries was a prey to the horrors of civil war. In testimony of their gratitude, the States caused the following inscription to be placed on the gate of the hotel de ville: *In Belgio omnia dum vastat civile bellum, MANSFELDUS bello et pace fidus, hanc provinciam in fide continet servatque illam, cum summo populi consensu et hilari jucunditate*. He was afterward appointed to the command of the Low Countries; and died at Luxembourg, March 21. 1604, at the age of 87, with the title of *Prince of the Holy Empire*. His mausoleum in bronze, which is to be seen in the chapel bearing his name, and adjoining to the Church of the Recollets at Luxembourg, is an admirable work. Four highly finished weepers, with which this monument was ornamented, were carried off by Louis XIV. when he took this city in 1684. To a love of war, Mansfeld united a taste for the sciences; and he was a lover and encourager of the arts: he possessed a great and elevated mind; but, like many heroes ancient and modern, he was greedy of gain and lavish of blood. Abbé Schannat has written the history of the count of Mansfeld in Latin; printed at Luxembourg, 1707. Charles prince of Mansfeld, his lawful son, signalized himself in the wars of Flanders and Hungary; and died without issue in 1595, after having beaten the Turks who attempted to relieve the city of Gran (Strigonia), which he was besieging.

MANSFELD (Ernest de), the illegitimate son of Peter Ernest by a lady of Malines, was educated at Brussels, in the principles of the Roman Catholic religion, by his godfather Ernest archduke of Austria. He was employed in the service of the king of Spain in the Low Countries, and in that of the emperor in Hungary, together with his brother Charles count of Mansfeld. He was legitimated on account of his bravery

Manſe
Mansfeld.

Mansfeld,
Mansfield.

bravery by the emperor Rodolphus II.; but his father's pofts and poffeffions in the Spanish Netherlands having been refufed him, contrary to promifes which he had received, he, in 1610, joined the party of the Proteftant princes. Being now become one of the moft dangerous enemies of the houfe of Auftria, who called him the *Attila of Chriftianity*, he fet himfelf, in 1618, at the head of the rebels in Bohemia, and got poffeffion of Pilfen in 1619. Though his troops were defeated in feveral battles, he was able to penetrate into the palatinate. He there took feveral places, ravaged Alface, made himfelf matter of Haguenau, and defeated the Bavarians. At length he was totally defeated by Walstein, at the battle of Daffou, which happened in the month of April 1626. He gave over his remaining troops to the Duke of Weimar, and intended to pafs into the Venetian States; but fell fick in a village between Zara and Spalatro, and there expired, A. D. 1626, aged 46. The procurator Nani thus defcribes him: "He was bold, intrepid in danger, and the moft fkillful negotiator of the age in which he lived. He poffeffed a natural eloquence, and well knew how to infinuate himfelf into the hearts of thofe whom he wifhed to gain. He was greedy of others wealth, and prodigal of his own.—He was full of vaft projects and great hopes, and yet poffeffed neither lands nor money at his death." He did not wifh to die in his bed; but drefled himfelf in his fineft robes, put on his fword, fat up, leaning upon two domeftics, and in this pofition, highly becoming a warrior, breathed his laft. But of all the actions of this great captain and fingular man, the following is without doubt the moft extraordinary: Having got the moft certain information that Cazel, in whom of all his officers he placed the greateft confidence, had communicated his plans to the Auftrian chief, he fhewed neither paffion nor refentment at his treachery, but gave him 300 rix-dollars, and fent him to count Buquoy, with a letter expreffed in thefe words, "Cazel being attached to you and not to me, I fend him to you, that you may have the benefit of his fervices." The opinions of men were divided about this action, and it was as much cenfured as applauded. Be this as it may, Ernelt is defervedly efteemed one of the greateft generals of his age. There never was a leader more patient, more indefatigable, more inured to toil and hardfhip, to watchings, to cold, and to hunger. He raifed armies, and ravaged the enemy's territories with an incredible celerity. The Hollanders faid of him, that he was *bonus in auxilio, carus in pretio*; that is, that he rendered great fervices to thofe who employed him, but that he made them pay well for it.

MANSFELD (Henry-Francis, count of), was of the fame houfe with the former, and fignalized himfelf in the wars for the Spanish fucceffion. He died at Vienna on the 8th of June 1715, at the age of 74, after being a prince of the Holy Empire, a grandee of Spain, field-marshal general of the emperor's armies, general of artillery, ambaffador to France and Spain, prefident of the Aulic council, and great chamberlain to the emperor.

MANSFIELD, a town of Nottinghamfhire, in England, feated in the foreft of Sherwood, 140 miles from London. It was anciently a royal demefne. It

has a market on Thursdays, and two fairs. By an ancient cuftom of this manor, the heirs were declared of age as foon as born. It is a well-built town, and drives a great trade in malt. Its market is well-ftocked with corn, cattle, &c. Here is a charity-fchool for 36 boys.

MANSIO, a term often mentioned in itineraries, denoting *inn*: on the public roads to lodge in, at the diftance of eighteen miles from each other; (Lactantius). Alfo, in the lower ages, it came to denote "an encampment for one night," (Lampri-dius).

MANSIO, or *Manfus*, was fometimes alfo ufed in the fame fenfe with *bide*; that is, for as much land as one plough could till in a year. See *HIDE*.

MANSION, MANSIO, a dwelling-houfe, or habitation, efpecially in the country. See *MANSE*.

MANSION is more particularly ufed for the lord's chief dwelling-houfe within his fee; or otherwife called the *capital manfage* or *manfe*, or chief manor-place. See *MANOR*.

MANSLAUGHTER, the unlawful killing of another, without malice either exprefs or implied: Which may be either voluntarily, upon a fudden heat; or involuntarily, but in the commiffion of fome unlawful act. Thefe were called, in the Gothic conftitutions, *homicidia vulgaria*; *que aut cafu, aut etiam fponte committuntur, fed in fubitaneo quodam iracundie calore et impetu*. And hence it follows, that in manflaughter there can be no accessories before the fact; becaufe it muft be done without premeditation.

1. As to the firft, or voluntary branch: If upon a fudden quarrel two perfons fight, and one of them kills the other, this is manflaughter: and fo it is, if they upon fuch an occafion go out and fight in a field; for this is one continued act of paffion: and the law lays that regard to human frailty, as not to put a hafty and deliberate act upon the fame footing with regard to guilt. So alfo if a man be greatly provoked, as by pulling his nofe, or other great indignity, and immediately kills the aggreffor; though this is not excufable *fe defendendo*, fince there is no abfolute neceffity for doing it to preferve himfelf; yet neither is it murder, for there is no previous malice; but it is manflaughter. But in this, and in every other cafe of homicide upon provocation, if there be a fufficient cooling-time for paffion to fubfide and reafon to interpoze, and the perfon fo provoked afterwards kills the other, this is deliberate revenge, and not heat of blood; and accordingly amounts to murder. So if a man takes another in the act of adultery with his wife, and kills him direftly upon the fpot; though this was allowed by the law of Solon, as likewife by the Roman civil law (if the adulterer was found in the husband's own houfe), and alfo among the ancient Goths; yet in England it is not abfolutely ranked in the clafs of juftifiable homicide, as in cafe of a forcible rape, but it is manflaughter. It is, however, the loweft degree of it; and therefore in fuch a cafe the court directed the burning in the hand to be gently inflicted, becaufe there could not be a greater provocation. Manflaughter, therefore, on a fudden provocation, differs from excufable homicide *fe defendendo* in this: That in one

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case there is apparent necessity, for self-preservation, to kill the aggressor; in the other no necessity at all, being only a sudden act of revenge.

2. The second branch, or involuntary manslaughter, differs also from homicide executable by misadventure, in this: That misadventure always happens in consequence of a lawful act, but this species of manslaughter in consequence of an unlawful one. As if two persons play at sword and buckler, unless by the king's command, and one of them kills the other: this is manslaughter, because the original act was unlawful; but it is not murder, for the one had no intent to do the other any personal mischief. So where a person does an act, lawful in itself, but in an unlawful manner, and without due caution and circumspection; as when a workman slings down a stone or piece of timber into the street, and kills a man; this may be either misadventure, manslaughter, or murder according to the circumstances under which the original act was done. If it were in a country village, where few passengers are, and he calls out to all people to have a care, it is misadventure only: but if it were in London, or other populous towns, where people are continually passing, it is manslaughter, though he gives loud warning; and murder, if he knows of their passing and gives no warning at all, for then it is malice against all mankind. And, in general, when an involuntary killing happens in consequence of an unlawful act, it will be either murder or manslaughter according to the nature of the act which occasioned it. If it be in prosecution of a felonious intent, or in its consequences naturally tending to bloodshed, it will be murder; but if no more was intended than a mere civil trespass, it will only amount to manslaughter.

3. As to the punishment of this degree of homicide: The crime of manslaughter amounts to felony, but within the benefit of clergy; and the offender shall be burnt in the hand, and forfeit all his goods and chattels.

But there is one species of manslaughter, which is punished as murder, the benefit of clergy being taken away from it by statute; namely, the offence of mortally stabbing another, though done upon sudden provocation. See STABBING.

MANSTEIN (Christopher Herman of), was born at Petersburg, Sept. 1. 1711, and for a long time served with great distinction as a colonel in the Russian armies. In 1745 he went into the service of the king of Prussia; was appointed major-general of infantry in 1754; and distinguished himself on all occasions by his bravery and his knowledge of the art of war. He was wounded at the battle of Kolin, and soon after killed near Leutmeritz. He was universally regretted by those who knew him; and even the enemy shed tears upon the occasion.—Those leisure moments which the laborious profession of war allowed him to enjoy, Mantien dedicated to study. He was acquainted with almost all the languages of Europe. From him we have Historical, Political, and Military Memoirs of (Russia, Lyons, 1772), 2 vols, 8vo, with plans and charts. These memoirs commence with the death of Catherine I. 1727, and end in 1744. He was an eyewitness, or had a very intimate knowledge, of all the events contained in them. A supplement is added,

Nº 194.

which goes back to the times of the ancient Cæars, and in particular treats to a considerable length on Peter I. At the conclusion of the work, the author gives an idea of the military and naval force, of the trade, &c. of this extensive empire. The facts contained in this little historical tract, are not more interesting in themselves than they are valuable on account of the candor of the historian, who witnessed every event which he relates. Mr Hume having received the original French of these memoirs, caused them to be translated into English, and published at London; soon after there appeared a German translation of them, published at Hamburg. A French edition was published by M. Huber at Leipzig in 1771; and there appeared a new and enlarged edition in 1782.

MANTA, in ichthyology; a flat fish mentioned by Uloa and others, as exceedingly hurtful to the pearl-fishers, and which seems to be the same with that which Pliny has described under the name of *nubes* or *nebula*: *Ipsi ferunt* (Urinatores) *et nubem quandam crassescere super capita, planorum piscium similem, prementem eos, arcantemque a reciprocando et ob filios praecutos lineis annexos habere sese; quia in se persossa ita, non recedant caliginis et pavoris, ut arbitror, opere. Nubem enim sive nebulam (cujus nomine id malum appellant) inter animalia haud ullam reperit quisquam.* (Plin. Hist. Nat. lib. ix. cap. 46.) The account given of this cloud by those divers is much the same with that which the divers in the American seas give of the *manta*, and the name of the cloud is perfectly applicable to it, as it really seems to be a cloud to those who are in the water below it: the swimmers likewise carry long knives, or sharp sticks, for the purpose of dispersing this animal. It is not improbable, that this fish has made its way into these seas from those of the old world in the same manner as some others appear to have done. The strength of this fish is so great, that it will not only strangle a man whom it embraces or winds itself about, but it has even been seen to take the cable of an anchor and move it from the place where it had been cast. It has been called *manta*, because, when it lies stretched upon the sea, as it frequently does, it seems like a fleece of wool floating upon the water.

MANTE, a considerable town of France, capital of the Mantois; seated on the river Seine, in E. Long. 1. 45. N. Lat. 48. 58.

MANTEGAR, or MAN-TIGER, as it is sometimes written, in zoology, is the tufted ape, a species of simia. See SIMIA.

MANTEGNA (Andrew), was born in a village near Padua in 1451, and at first employed in keeping sheep. It was observed, that instead of watching over his flock, he amused himself with drawing; and he was placed with a painter who, being delighted with his ease and taste in work, and with his gentle and agreeable conduct in society, adopted him for his son, and made him his heir. At the age of 17, Mantegna was employed to paint the altar of St Sophia in Padua, and the four evangelists. James Bellini, who admired his talents, gave him his daughter in marriage. Mantegna painted, for the duke of Mantua, the *Triumph of Caesar*, which is the chief d'oeuvre of this painter, and has been engraved in *claro-obscuro*, in nine plates. From respect to his extraordinary merit, the duke

Manta
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Mantegna.

Mantelets made him knight of his order. The invention of engraving prints with the graver is commonly ascribed to Mantegna, who died at Mantua in 1517.

MANTELETS, in the art of war, a kind of moveable parapets, made of planks about three inches thick, nailed one over another, to the height of almost six feet, generally cased with tin, and set upon little wheels, so that in a siege they may be driven before the pioneers, and serve as blinds to shelter them from the enemy's small shot.

MANTICHORA, in natural history, a name given by the Roman authors to a fierce and terrible creature, which they describe from the Greeks, who call it sometimes also *manticora*; but when they write more correctly, *martichora* and *martiora*. We have formed the name *man-tiger* on the found of the Roman name, tho' expressing a very different sense; and our authors of the histories of animals, figure to us under this name a terrible creature, partly from the accounts of Pliny exaggerated, and partly from their own imagination, with three rows of teeth, and with such a shape as no animal ever possessed. See **MANTEGAR**.

The whole story of this animal seems founded on the love of the wonderful; and very probably the *manticora*, properly speaking, was no other than some of the larger hyænas, which was at first ill described, and afterwards more and more wonders were added to the story, till all shadow of truth was lost.

MANTINEA (anc. geog.), a town situated in the south of Arcadia, on the confines of Laconia (Ptolemy); called afterwards *Antigonea*, in honour of king Antigonus. It is memorable for a battle fought in its neighbourhood between the Thebans and Spartans, in which fell the celebrated commander Epaminondas. See **THEBES**.

MANTIS, in zoology, a genus of insects belonging to the order of hemiptera, the characters of which are these: The head is unsteady, or appears from its continual nodding motion to be slightly attached to the thorax: The mouth is armed with jaws, and furnished with filiform palpi: The antennæ are setaceous: The four wings are membranaceous, and wrapped round the body; the under ones folded: The anterior or first pair of feet are compressed, armed on the under side with teeth like a saw, and terminated by a single nail or crotchet; the four hindmost are gressorii, or formed rather for advancing slowly than for performing quick movements: The thorax is extended to a considerable length, narrow, and throughout of equal size. The name *mantis*, given to this genus, denotes *foothsayer*; because it has been imagined, that this insect, by stretching out its fore feet, divined and pointed out those things that were asked of it. The insect often rests on its four hinder legs only, and holding the two fore ones raised up, joins them together, which has occasioned its being called by the people of Languedoc, where it is very common, *pregadious*, as if it prayed to God. The country folks moreover maintain, that this creature shows the way when asked, because it stretches those same fore legs sometimes to the right and sometimes to the left: and indeed it is looked upon as an insect almost sacred, that must not be hurt. Its colour is all over of a brownish green. The young ones have more of the green, the old more of the brown, cast. It deposits its eggs collected in-

to a hemispherical parcel, flat on one side. There are in the parcel two rows of oblong eggs placed transversely, and one row of shells placed longitudinally, in form of a roof, one over the other, which cover the joining of the two rows of eggs. The whole parcel is light, and as it were composed of very thin parchment.

There are 53 species of this genus. In plate CCLXXXIX is represented the gongyloides, the shape of which is extraordinary, being narrow and long. The head is small, flat, with two filiform short antennæ. On the sides of the head are situated two large polished eyes. The thorax is subulated, long, narrow, margined, with a longitudinal rising in the middle, and a transverse depression at one-third of its length. The elytra, which cover two thirds of the insect, are veined, reticulated, crossed one over the other, and cover the wings, which are veined, and diaphanous. The hinder legs are very long, the middle ones shorter; and the foremost pair of thighs are terminated with spines, the rest winged, as it were, with membranaceous lobes. The top of the head has the shape of an awl; is membranaceous, often split in two at the extremity. It is an inhabitant of China.

The insects belonging to this genus, in their most perfect state, are generally of very beautiful green colours, which soon fade, and become the colour of dead leaves. Their elytra bearing so strong a resemblance to the leaves of some plants, have procured them the name of *walking leaves*.

MANTLE, or **MANTLE-Tree**, in architecture, the lower part of the chimney, or that piece of timber which is laid across the jaumbs, and sustains the compartments of the chimney-piece.

MANTLE, or **Mantling**, in heraldry, that appearance of folding of cloth, flourishing, or drapery, which in any achievement is drawn about a coat of arms. See **HERALDRY**, p. 464. Sect. V.

MANTO, in poetic history, the daughter of Tiresias, and like her father strongly inspired with prophecy. She was in so great esteem, that when the Argives pillaged Thebes, they thought they could not acquit their vow to Apollo, of consecrating to him the most precious thing in their plunder, without offering him this young woman. She was therefore sent to the temple of Delphi. But this did not engage her in any vow of continency; or, if it did, she observed it very ill: for she bore a son called *Amphilochus* to Alemeon, who had been generalissimo of the army which took Thebes; and a daughter to the same, named *Tisiphone*. These children were the fruits of an amour carried on during the madness which had seized Alemeon, after he had put his mother to death. Virgil transports her into Italy, not for the sake of securing her virginity, but to produce a son of her who built Mantua.

MANTUA, anciently a town of the Transpadana in Italy, situated on the Mincius, a river running from the Lacus Benacus. It is said to have been founded about 300 years before Rome by Bianor or Oenus, the son of Manto; and was the ancient capital of Etruria. When Cremona, which had followed the interest of Brutus, was given to the soldiers of Octavius, Mantua also, which was in the neighbourhood, shared the common calamity, and many of the inhabitants

Mantle
Mantua

were tyrannically deprived of their possessions. Virgil, who was among them and a native of the town, applied for redress to Augustus, and obtained it by means of his poetical talents.

It is still called MANTUA, and is the capital of the duchy of that name. It is now a large place, having eight gates and about 16,000 inhabitants. The streets are broad and straight, and the houses well built. It is very strong by situation as well as by art; lying in the middle of a lake, or rather morass, formed by the river Minchio. There is no access to the city but by two causeways which cross this morass, and which are strongly fortified: so that the city is looked upon to be one of the most considerable fortresses of Europe; and the allies in 1745, though their army was in the duchy, durst not undertake the siege. It was greatly noted for its silk-manufactures, which are now much decayed. The air in the summer-time is very unwholesome. The celebrated poet Virgil was born at a village near this city. E. Long. 10. 47. N. Lat. 45. 10.

MANTUA, the duchy of, a country of Italy, lying along the river Po, which divides it into two parts. It is bounded on the north by the Veronese; on the south by the duchies of Reggio, Modena, and Mirandola; on the east by the Ferrarese; and on the west by the Cremonese. It is about 50 miles in length, and 25 in breadth; is fruitful in corn, pastures, flax, fruits, and excellent wine. Charles IV. the last duke of Mantua, being a vassal of the empire, took part with the French in the dispute relating to the succession of Spain; for which reason he was put under the ban of the empire, and died at Venice in 1708. He having no heirs, the emperor kept the Mantuan in his own hands, and the duke of Savoy had Montferrat, which were confirmed to them by subsequent treaties. After the death of the emperor in 1740, his eldest daughter, now empress-queen, kept possession of the Mantuan; and the governor of the Milanese had the administration of affairs. The Mantuan comprehends the duchies of Mantua, Guastalla, and Sabioneta; the principalities of Castiglione, Solferino, and Bofolo; likewise the county of Novellara. The principal rivers are the Po, the Oglio, and the Minchio; and the principal town is Mantua.

MANTUAN (Baptist), a famous Italian poet, born at Mantua in 1448. He took his name from the town; not having a right to that of his father, as being a natural son. In his youth, he applied himself to Latin poetry, which he cultivated all his life; for it does not appear that he wrote any thing in Italian. He entered among the Carmelites, and became general of the order; though he quitted that dignity upon some disgust in 1513, and died the year following. The duke of Mantua, some years after, erected a marble statue to his memory crowned with laurel, and placed it next to Virgil. His works were collected and published at Paris in three volumes folio in 1513, with the commentaries of St Murrhon, S. Brant, and I. Badius.

MANUAL, a word signifying any thing performed by the hand.

MANUAL (*manualis*), in law, signifies what is employed or used by the hand, and whereof a present profit may be made: as such a thing in the manual

occupation of one is where it is actually used or employed by him.

MANUAL is the name of a service-book used in the church of Rome, containing the rites, directions to the priests, and prayers used in the administration of baptism and other sacraments; the form of blessing holy water, and the whole service used in processions.

MANUAL Exercise, in the army, consists in the observance of certain words of command appointed for this purpose. When a regiment is drawn up, or paraded for exercise, the men are placed three deep, either by companies, or divided into platoons, with the grenadiers on the right. When soldiers are drawn up for exercise, the ranks and files should be exactly even; and each soldier should be instructed to carry his arms well, to keep his firelock steady and even upon his shoulder, with the right hand hanging down, and the whole body without constraint. The distances between the files must be equal, and the ranks eight feet distant from each other. Every motion should be performed with life, and the greatest exactness observed in all fringes, wheelings, and marching; and therefore a regiment should never be under arms longer than two hours.

The following is an abstract of the words of command at the manual exercise, with their explanations.

1. *Pass your firelock*: i. e. Seize the firelock with your right hand, and turn the lock outwards, keeping the firelock perpendicular; then bring up the firelock with a quick motion from the shoulder, and seize it with the left hand, just above the lock, so that the fingers may lie upon the stock, with the elbows down, and the thumb upon the stock; the firelock must not be held too far from the body, and the left-hand must be of an equal height with the eyes.
2. *Cock your firelock*: i. e. Turn the barrel opposite to your face, and place your thumb upon the cock, raising your elbow square at this motion; then cock your firelock, by drawing your elbow down, placing your right thumb on the breech-pin, and the fingers under the guard.
3. *Present*: i. e. Step back about six inches to the rear with the right-foot, bringing the left-toe to the front; at the same time the butt-end of the firelock must be brought to an equal height with the shoulder, placing the left-hand on the swell, and the fore-finger of the right-hand before the trigger, sinking the muzzle a little.
4. *Fire*: i. e. Pull the trigger briskly, and immediately after, bringing up the right-foot to the inside of the left, come to the priming position, with the lock opposite to the right-breast, the muzzle to the height of the hat, keeping it firm and steady; and at the same time seize the cock with the fore-finger and thumb of the right hand, the back of the hand being turned up.
5. *Half-cock your firelock*: i. e. Half-bend the cock briskly with a draw-back of the right-elbow, bringing it close to the butt of the firelock.
6. *Handle your cartridges*: i. e. Bring your right-hand with a short round to your pouch, slapping it hard; seize the cartridge, and bring it with a quick motion to your mouth; bite the top well off, and bring the head as low as the chin, with the elbow down.
7. *Prime*: i. e. Shake the powder into the pan, placing the three last fingers behind the rammer, with the elbow up.
8. *Shut your pans*: i. e. Shut your pans briskly, drawing your right-arm at this motion.

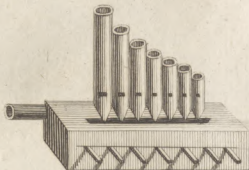
Machul.



N^o 2.



Masrakitha.



Magrakochill.



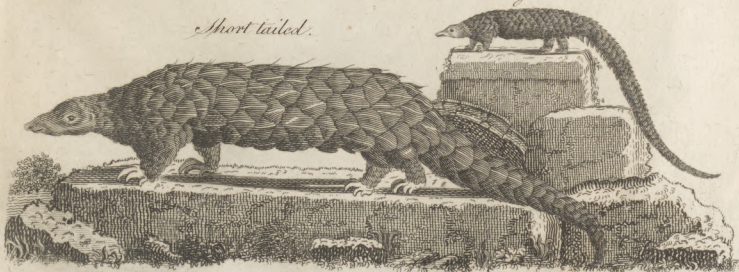
Mantis.



Mantis or Lizard.

Long tailed.

Short tailed.



Abell Penn. Nalis sculptor fecit.

motion towards your body, holding the cartridge fast in your hand, as before; then turn the piece nimbly round to the loading position, with the lock to the front, and the muzzle to the height of the chin, bringing the right hand behind the muzzle, with both feet kept fast in this motion. 9. *Charge with cartridge*: i. e. Turn up your hand, and put the cartridge into the muzzle, shaking the powder into the barrel; place your hand, closed, with a quick and strong motion, upon the rammer. 10. *Draw your rammer*: i. e. Draw the rammer with a quick motion half out, seizing it at the muzzle back-handed; draw it quite out, turn it, and enter it into the muzzle. 11. *Ram down your charge*: i. e. Ram the cartridge well down in the barrel, instantly recovering and seizing the rammer back-handed at the centre, turning it, and entering it as far as the lower pipe, placing at the same time the edge of the hand on the butt end of the rammer, with fingers extended. 12. *Return your rammer*: i. e. Return the rammer, bringing up the piece with the left-hand to the shoulder, seizing it with the right-hand under the cock, keeping the left-hand fast at the swell, turning the body square to the front. 13. *Shoulder your firelock*: i. e. Quit the left-hand, and place it strong upon the butt; quit the right hand, and throw it down the right-side. 14. *Rest your firelock*: i. e. Seize the firelock with the right-hand, turning the lock outwards; raise the firelock from the shoulder, and place your left-hand with a quick motion above the lock, holding the piece right up and down in both hands before you, and your left-hand even with your eyes; step briskly back with your right-foot, placing it a hand's-breadth distance from your left-heel, and at the same time bring down your firelock as quick as possible to the rest, sinking it as far down before your left-hand as your right-hand will permit without constraint; your left hand being at the feather-spring, and your right, with fingers extended, held under the guard, taking care to draw in the muzzle well towards your body, and to dress in a line with the butt-end. 15. *Order your firelock*: i. e. Place your firelock nimbly with your left-hand against your right-shoulder; quit the firelock with the right-hand, sinking it at the same time with your left; seize it at the muzzle, which must be of an equal height with your chin, and hold it close against your right-side; lift up your right-foot, and place it by your left; at the same time throw back your left-hand by your left-side, and with your right bring down the butt-end strong upon the ground, placing it even with the toe of your right-foot; the thumb of your right-hand lying along the barrel, and the muzzle kept at a little distance from your body. 16. *Ground your firelock*: i. e. Half-face to the right upon your heels, and at the same time turn the firelock, so that the lock may point to the rear, and the flat of the butt-end lie against the inside of your foot; at the same time slipping the right-foot behind the butt of the firelock, the right-toe pointing to the right, and the left to the front: step directly forward with your left-foot, about as far as the swell of the firelock, and lay it upon the ground, your left-hand hanging down by your left-leg, and your right kept fast, with the butt-end against it; raise yourself up again nimbly, bringing back your left-foot to its former position, keeping your body faced to the right;

face again to the left upon your heels, and come to your proper front, letting your hands hang down without motion. 17. *Take up your firelock*: i. e. Face to the right upon both heels; sink your body down, and come to the position described in the second motion of grounding; raise yourself and firelock, bringing it close to your right side; come to your proper front, seizing your firelock at the muzzle, as in explanation 15. 18. *Rest your firelock*: i. e. Bring your right-hand as far as the swell; raise the firelock high up in a perpendicular line from the ground with your right-hand, and seize it with your left above the spring, the cock being at the height of the waist-belt; step back with your right-foot, placing it behind your left-heel, and come to the rest. 19. *Shoulder your firelock*: i. e. Lift up your right-foot, and place it by your left; bring the firelock at the same time to your left-shoulder, and seize the butt-end with the left-hand, keeping it in the same position as above described; throw your right-hand briskly back. 20. *Secure your firelock*: i. e. Bring the right-hand briskly up, and place it under the cock, keeping the firelock steady in the same position; quit the butt with the left-hand, and seize the firelock with it at the swell, bringing the elbow close down upon the lock; the right-hand being kept fast in this motion, and the piece still upright; quit the right-hand, and bring it down your right-side, bringing the firelock nimbly down to the secure; the left-hand in a line with the waist-belt. 21. *Shoulder your firelock*: i. e. Bring the firelock up to a perpendicular line, seizing it with the right-hand under the cock; quit the left-hand, and place it strong upon the butt; quit the right hand, and bring it smartly down the right-side. 22. *Fix your bayonet*: i. e. First and second motions, as in the two first of the secure; quit the right-hand, and bring the firelock smartly down to the left-side with the left-hand, as far as it will admit without constraint, seizing the bayonet at the same time with the right-hand, and fixing it, placing that hand just below the brass, with the piece kept close to the hollow of the shoulder. 23. *Shoulder your firelock*: i. e. Quit the right-hand, and bring up the firelock with the left; seize it again under the cock with your right, as in the second motion of the secure; quit the left-hand, and place it strong upon the butt; quit the right-hand, and bring it down the right side. 24. *Present your arms*: i. e. as explained in three motions of the 14th word of command. 25. *To the right face*: i. e. Bring up the firelock with a quick motion high before you, till your left-hand comes even with your eyes, with the fingers of that hand extended along the stock, just above the feather-spring, the right-foot to be brought close up to the left-heel in this motion; face to the right, taking care in facing to hold the firelock right up and down, and steady in your hands; step back with your right-foot, and come down to your present, as in the foregoing explanation. 26. *To the right face*: i. e. as in the foregoing explanation, facing to the right. 27. *To the right-about face*: i. e. as in the 24th explanation, only coming to the right-about instead of to the right. 28. *To the left face*: i. e. Bring the right-foot briskly to the hollow of your left, with the firelock in the same position as in the first motion of facing to the right; face to the left; come down to the present, as before. 29. *To the left face*: i. e. as

in the foregoing explanation. 30. *To the left-about face*; i. e. as before, coming to the left-about instead of to the left. 31. *Shoulder your firelock*; i. e. as in the two motions of the 19th explanation. 32. *Charge your bayonet*; i. e. as in the first explanation: bring the swell of the firelock down strong upon the palm of the hand, grasping the piece at the small, behind the lock, and as high as the waist-belt; the firelock upon a level with the barrel upwards. 33. *Shoulder your firelock*; i. e. Bring up the firelock to the shoulder, place the left-hand upon the butt, bringing the feet square to the front; quit the right-hand, and throw it down the right side. 34. *Advance your arms*; i. e. first and second motions, as in the first explanation: bring the firelock down the right-side, with the right-hand as low as it will admit without constraint, slipping up the left-hand at the same time to the swell, the guard between the thumb and fore-finger of the right-hand, the three last fingers under the cock, with the barrel to the rear; quit the left-hand. 35. *Shoulder your firelock*; i. e. bring up the left-hand, and seize it at the swell; come smartly up to the poise; shoulder. 36. *Prime and load*; i. e. Come smartly to the recover, by springing the firelock straight up with the left-hand, turning the barrel inwards to the proper height of the recover: at the same time that the left-hand springs the firelock, the right-hand is raised briskly from the right-side, and seizes the firelock across the breast: as it rises below the cock, the left-hand comes with a quick motion from the butt, and seizes the firelock strong above the lock, the little finger of the left-hand at the spring of the lock, the left-hand at an equal height with the face, the butt close to the body, but not pressed, the firelock perpendicular opposite the left-side of the face: bring the firelock down with a brisk motion to the priming position, the left-hand holding the firelock, as in priming; the thumb of the right-hand placed against the face of the steel, the fingers clinched, and the elbow a little turned out, that the wrist may be clear of the cock: open the pan, by throwing up the steel with a strong motion of the right arm, turning the elbow in, and keeping the firelock steady in the left-hand; handle your cartridge, prime, shut your pan, call about, load, draw rammers, ram down the cartridge, return the rammers, shoulder. N. B. The motion of recover, and coming down to the priming position and opening pans, are to be done in the usual time. The motions of handling cartridge to shutting the pans, are to be done as quick as possible: when the pans are shut, a small pause is to be made, and then call about together; then the loading motions are to be done as quick as possible; but before the rammer is returned, another small pause is to be made, counting 1, 2, between each motion, till the firelock is shouldered.—*Front rank, make ready*: i. e. Spring the firelock briskly to the recover, keeping the left-foot fast in this motion; as soon as the firelock is at the recover, without any stop, sink the body briskly without stooping forward, with a quick motion down upon the right-knee; the butt-end of the firelock at the same time falls upon the ground, the front part of the butt being in a line with the heel of the left-foot. As soon as the butt comes to the ground, the firelock is to be cocked, immediately seizing the cock and steel in the right-hand; the

firelock to be held firm in the left-hand, about the middle of that part of the firelock between the lock and the swell of the stock; the point of the left-thumb to be close to the swell, pointing upwards. As the body is sinking, the right-knee is to be thrown as far back as the left-leg may be right up and down; the right foot to be thrown a little to the right; the body to be kept straight; the head up, looking to the right along the rank, the same as if shouldered; the firelock to be upright, and the butt about four inches to the right of the inside of the left-foot. *Present*: i. e. Bring the firelock briskly down to the present, by extending the left-arm to the full length with a strong motion; at the same time spring up the butt by the cock with the right-hand, and raise the butt so high upon the right-shoulder, that you may not be obliged to stoop too much with the head; the right-cheek to be close to the butt, and the left-eye shut, and look along the barrel with the right-eye from the breech-pin to the muzzle; keep the left-elbow down in an easy position, and stand as steady as possible; the thumb of the right-hand to remain in the position as described in the third explanation of the manual. *Fire*: i. e. Pull the trigger as directed in the manual; and as soon as the piece is fired, give yourself a strong spring upon your left-leg, raising your body briskly, and straight up, keeping your left-foot fast, and bringing the right-heel to the inside of the left; at the same time the firelock is to be brought up to the priming-position, and half-cocked immediately: a short pause is to be made; then handle cartridge, and go on with the loading motions described in the explanation of *prime and load*.—*Centre rank, make ready*: i. e. Spring the firelock briskly to the recover; so soon as the left-hand seizes the firelock above the lock, the right-elbow is to be nimble raised a little, placing the thumb of that hand upon the cock; the fingers open by the plate of the lock, and as quick as possible force the piece to the cock, by dropping the elbow, and forcing down the cock with the thumb, stepping at the same time a moderate pace to the right, keeping the left foot fast; as the firelock is cocked, the thumb is to fall below the cock, the right-hand seizing the firelock close under the cock firmly, the fore-finger not to be before the trigger; the piece to be held in this position perpendicular, opposite the left-side of the face, the butt close to the left-breast, but not pressed; the body to be straight, and as full to the front as possible; the head kept up, looking to the right of the rank, that the body and the firelock may not stoop forward, nor lean much out of the rank. *Present*: i. e. Spring the firelock from the body to the arm's length with a quick motion, pressing down the muzzle with the left-hand, and spring up the butt with the right-hand, as in the foregoing explanation of the *front-rank*. *Fire*. As in explanation 4, in the manual, with this difference, that the left-foot is to be brought up to the right, at the same time that the firelock is brought down to the priming position. The loading motions as in the explanations of priming and loading; and at the last motion of shouldering, to spring to the left again, and cover the file-leaders.—*Rear rank, make ready*: i. e. Recover the firelock, and cock as before directed for the centre-rank; as the firelock is recovered and cocked, step briskly straight to the right, with the right-foot,

Manuductor II **Maunition** sign. foot, a full pace; bring the left-heel about six inches before the right-foot; the body straight, and as square to the front as possible, as in the explanation of the *centre-rank*. *Present*: As in explanation *present*, before. *Fire*: As in explanation of the *centre rank*; and as the firelock is coming down to the priming position, the left is to be brought back to the right; and at the last motion of shouldering, to spring to the left again, and cover the file-leader.

There are some peculiar words of command at the manual exercise of the grenadiers, when apart from the battalion; and also for the cavalry and artillery.

MANUDUCTOR, a name given to an ancient officer in the church; who, from the middle of the choir, where he was placed, gave the signal for the choirists to sing, and marked the measure, beat time, and regulated the music. The Greeks called him *me-fachoras*, because seated in the middle of the choir; but in the Latin church he was called *manuductor*; from *manus* and *duco*, "I lead;" because he led and guided the choir by the motions and gesture of the hand.

MANUFACTURE, a commodity produced from raw or natural materials, either by the work of the hand or by machinery.

MANUFACTURER, one who works up a natural product into an artificial commodity.

MANUMISSION, an act whereby a slave or villain is set at liberty, or let out of bondage. The word comes from the Latin *manus*, "hand;" and *mittere*, "to send;" *quia servus mittebatur extra manum seu potestatem domini sui*. Some authors define manumission an act by which a lord enfranchises his tenants, who till that time had been his vassals, and in a state of slavery inconsistent with the sanctity of the Christian faith.

Among the Romans, the manumission of slaves was performed three several ways. 1. When, with his master's consent, a slave had his name entered in the census or public register of the citizens. 2. When the slave was led before the prætor, and that magistrate laid his hand called *vindicta* on his head. 3. When the master gave the slave his freedom by his testament. Servius Tullius is said to have set on foot the first manner; and P. Valerius Publicola the second. A particular account is given of the third in the Institutes of Justinian. It was not necessary that the prætor should be on his tribunal to perform the ceremony of manumission: he did it any where indifferently, in his house, in the street, in going to bathe, &c. He laid the rod on the slave's head, pronouncing these words, *Dico eum liberum esse more Quiritum*, "I declare him a freeman, after the manner of the Romans." This done, he gave the rod to the lictor, who struck the slave with it on the head, and afterwards with his hand on his face and back; and the notary or scribe entered the name of the new-freed man in the register, with the reasons of his manumission. The slave had likewise his head shaved, and a cup given him by his master as a token of freedom. Tertullian adds, that he had then also a third name given him: if this were so, three names were not a token of nobility, but of freedom. The emperor Constantine ordered the manumissions at Rome to be performed in the churches.

Of manumission there have also been various forms in England. In the time of the Conqueror, villains were manumitted, by the master's delivering them by the right hand to the viscount, in full court, showing them the door, giving them a lance and a sword, and proclaiming them free. Others were manumitted by charter. There was also an implicit manumission; as when the lord made an obligation for payment of money to the bondman at a certain day, or sued him where he might enter without suit, and the like.

MANURE, any thing used for fattening and improving land. See **AGRICULTURE**, Part I. Sect. I. II. and III.

MANUSCRIPT, a book or paper written with the hand; by which it stands opposed to a printed book or paper. A manuscript is usually denoted by the two letters MS. and in the plural by MSS. What makes public libraries valuable is the number of ancient manuscripts deposited in them; see **ALEXANDRIAN**, **CAMBRIDGE**, **CLERMONT**, **COTTONIAN**, **HARLEIAN**, **VATICAN**, &c.

MANUTIUS (Aldus), the first of those celebrated Venetian printers who were as illustrious for their learning as for uncommon skill in their profession. He was born at Bassano in Italy about the middle of the 15th century; and hence is sometimes called *Bassianus*, though generally better known by the name of *Aldus*. He was the first who printed Greek neatly and correctly; and acquired so much reputation by it, that whatever was finely printed was proverbially said to have "come from the press of Aldus." We have a kind of Greek grammar of his; with Notes upon Homer, Horace, &c. He died at Venice, where he exercised his profession, in 1516.

MANUTIUS (Paulus), son of the former, was brought up to his father's profession. He was more learned than him; and he acquired, by continual reading of Tully, such a purity in writing Latin, that even Scaliger allows a Roman could not exceed. Pope Pius IV. placed him at the head of the apostolical press, and gave him the charge of the Vatican library. His Epistles are infinitely laboured, and very correct; but, as may be said of most of the Ciceronians, they contain scarcely any thing but mere words. This constant reading of Tully, however, together with his profound knowledge of antiquity, qualified him extremely well for an editor of Tully; whose works he accordingly published, with Commentaries on them, in 4 vols folio, at Venice in 1523. He died in 1574.

MANUTIUS (Aldus), the Younger, the son of Paulus, and the grandson of Aldus, was esteemed one of the greatest geniuses and most learned men of his time. Clement VIII. gave him the direction of the Vatican printing-house; but probably the profits of that place were very small, since Manutius was obliged, for his subsistence, to accept of a professor of rhetoric's chair, and to sell the excellent library that was in his family, which his father, his uncle, and his great-uncle, had collected with extraordinary care, and which it is said contained 80,000 volumes. He died at Rome in 1597, without any other recompense than the praises due to his merit. He wrote, 1. Commentaries on Cicero. 2. A treatise on orthography. 3. Three books of epistles; and other works in Latin and Italian, which are esteemed.

Maon
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Maracaybo.

MAON (anc. geog.), a town of the tribe of Judah, to the south-east, towards the Dead Sea. It gave name to the *wilderness of Maon*, 1 Sam. xxii.

MAP, a plain figure, representing the surface of the earth, or a part thereof, according to the laws of perspective. See GEOGRAPHY, n° 63—73.

MAPLE. See ACER.

MAPLE-SUGAR. See SUGAR.

MAPLETOFT (Dr John), descended from a good family in Huntingdonshire, was born in 1631. He was educated in Trinity-college, Cambridge, and qualified himself for the profession of physic; and in 1675 was chosen professor of that art at Gresham college. He translated Dr Sydenham's *Observationes Medice circa morborum acutorum historiam et curationem* into the Latin, and Sydenham dedicated them to Mapletoft. He married in 1679, and soon after transferred his studies from physic to divinity; took orders; obtained the vicarage of St Laurence Jewry, with the lectureship of St Christopher's in London; and having been a benefactor to Sion college, was, in 1707, elected president. He continued to preach in his church of St Laurence Jewry till he was above 80 years of age; and in his decline printed a book intitled *The principles and duties of the Christian religion*, &c. 8vo. 1710, a copy of which he sent to every house in his parish. He was a polite scholar; and besides some other pieces on moral and theological subjects, there are in the Appendix to Ward's Lives of the professors of Gresham-college, three Latin lectures read there by him, on the origin of the art of medicine, and the history of its invention.

MAPPÀ, in the public games of the Roman circus, was a napkin hung out at the prætor's or other great magistrate's seat, as a signal for the race or other diversions to begin. The mappa was received by the mapparius, or person who held it, from the consul, prætor, or other great officer. Notice was anciently given by sound of trumpet; but Nero is said to have introduced the mappa, by throwing his napkin out of the window to satisfy the people, who grew noisy at the delay of the sports while he was at dinner.

MAPPARIUS, in Roman antiquity, the officer who gave the signal to the gladiators to begin fighting; which he did by throwing an handkerchief that he had received from the emperor or other magistrate.

MARACANDA (anc. geog.), capital of the Sogdiana. Now thought to be *Samarcand*, a city of Ubec Tartary in Asia, the country and royal residence of Tamerlane. See SAMARCAND.

MARACAYBO, a rich and considerable town of South America, and capital of the province of Venezuela, seated near a lake of the same name. It carries on a great trade in skins and chocolate, which is the best in America; and they have likewise very fine tobacco. It was taken by the French bucaniers in 1666 and 1678. W. Long. 70. 45. N. Lat. 10. 0.

MARACAYBO, a lake in South America, 200 miles long and 100 broad, which discharges itself by a river into the North Sea. It is well defended by strong forts; which, however, did not hinder Sir Henry Morgan, a bucanier, from entering it, and plundering several Spanish towns on the coast, after defeating a squadron sent out against him.

MARAGNAN, a province of Brazil in South America, which comprehends a fertile populous island, 112 miles in circumference. The French settled here in 1612, and built a town; but they were soon driven from thence by the Portuguese, who have possessed it ever since. The town is little, but strong; and has a castle, a harbour, and a bishop's see. The climate is very agreeable and wholesome, and the soil produces plenty of all the necessaries of life. W. Long. 54. 35. S. Lat. 2. 0.

MARALDI (James Philip), a learned mathematician and astronomer, of the academy of sciences at Paris, was born in 1665. He was the son of Francis Maraldi and Angela Catharine Casini, the sister of the famous astronomer of that name. His uncle made him go to France in 1687, where he acquired great reputation on account of his learning and observations. He made a catalogue of the fixed stars, which is more particular and exact than Bayer's; and has given a great number of curious and interesting observations in the memoirs of the academy; in particular, those on bees and petrifications have been universally applauded. He died in 1729.

MARANA (John Paul), an ingenious writer of the 17th century, was of a distinguished family, and born at Genoa; where he received an education suitable to his birth, and made a great progress in the study of polite literature and the sciences. Having been engaged in the conspiracy of Raphael della Terra, to deliver up Genoa to the duke of Savoy, he was in 1670, when 28 years of age, imprisoned in the tower of that city, and remained there four years. Being at length set at liberty, he was ordered to write the history of that conspiracy; but, when finished, it was seized and prevented from being published. When the republic of Genoa was at variance with the court of France, Marana, who had always an inclination for that court, was afraid of being imprisoned a second time; and retired to Monaco, where he again wrote the history of the conspiracy in Italian; and, in 1682, went to Lyons to get it printed. From Lyons he went to Paris, where his merit soon acquired him powerful protectors. He spent the rest of his life in a happy and tranquil mediocrity, devoted to study and the society of men of learning; and died in 1693. His history of the conspiracy contains many curious and interesting anecdotes, which are nowhere else to be found. He also wrote several other works; the most known of which is the *Turkish Spy*, in 6 vols 12mo, which was in 1742 augmented to seven. Of this ingenious work we have an excellent English translation.

MARANO, a town of Italy, in the territory of Venice and province of Friuli, with a strong citadel; seated in a marsh at the bottom of the Gulph of Venice, which renders it difficult of access.

MARANS, a rich town of France, in the territory of Aunis and diocese of Rochelle, seated among salt marshes, near the river Sevre, three miles from the sea. It carries on a very great trade in corn; and is seated in W. Long. 0. 55. N. Lat. 46. 20.

MARANTA, INDIAN ARROW-ROOT: A genus of the monogynia order, belonging to the monandra class of plants; and in the natural method ranking under the eighth order, *Scitamineæ*. The corolla is ringent

Maragnan
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Maranta.

Maranta ⁱⁱ **Marathon.** ringent and quinquefid, with two segments alternately patent. There are three species, the arundinacea, galanga, and comola, all of them herbaceous perennial exotics of the Indies, kept here in hot-houses for curiosity: they have thick, knotty, creeping roots, crowned with long, broad, arundinaceous leaves, ending in points, and upright stalks, half a yard high, terminated by bunches of monopetalous, ringent, five-parted flowers. They are propagated by parting the roots in spring, and planting them in pots of light rich earth, and then plunging them in the bark-bed. The root of the galanga is used by the Indians to extract the virus communicated by their poisoned arrows; from whence it has derived its name of *arrow root*. The arundinacea, or farch plant, rises to two feet, has broad pointed leaves, small white flowers, and one seed. It is cultivated in gardens and in provision-grounds in the West Indies; and the farch is obtained from it by the following process described by Dr Wright. "The roots when a year old are dug up, well washed in water, and then beaten in large deep wooden mortars to a pulp. This is thrown into a large tub of clean water. The whole is then well stirred, and the fibrous part wrung out by the hands, and thrown away. The milky liquor being passed through a hair sieve, or coarse cloth, is suffered to settle, and the clear water is drained off. At the bottom of the vessel is a white mass, which is again mixed with clean water and drained: lastly, the mass is dried on sheets in the sun, and is pure farch."—A decoction of the fresh roots (the Doctor informs us) makes an excellent ptilan in acute diseases.

MARASMUS, among physicians, denotes an atrophy or consumption in its last and most deplorable stage.

MARATHON (anc. geog.), one of the demi or hamlets of Attica; about 10 miles to the north-east of Athens, towards Boeotia, near the sea. It still retains its ancient name (Dr Chandler informs us); but is very inconsiderable, consisting only of a few houses and gardens. The plain of Marathon, famous for Miltiades's victory over the Persians, by which the liberties of Athens and other cities of Greece were saved, is long and narrow, but consisting chiefly of level ground, and therefore admitting the operations of cavalry, which formed the main strength of the barbarian army, and with which the Greeks were very poorly provided. Here the Persians, under the command of Datis, pitched their camp, by the advice of Hippias the banished king of Athens, whose solicitations and intrigues had promoted the expedition, and whose perfect knowledge of the country, and intimate acquaintance with the affairs of Greece, rendered his opinion on all occasions respectable. The Persian army is said to have consisted of 100,000 infantry, and 10,000 horse.—Athens was in the utmost consternation and dismay. She had, upon the first appearance of the Persian fleet, sent to implore assistance from the other nations of Greece; but some had submitted to Darius, and others trembled at the

very name of the Medes or Persians. The Lacedæmonians alone promised troops; but various obstacles did not allow them immediately to form a junction with those of Athens. This city therefore could only rely on its own strength; and happily at this moment there appeared three men destined to give new energy to the state. These were Miltiades, Ariftides, and Themistocles; whose example and harangues kindled the flame of the noblest heroism in the minds of the Athenians. Levies were immediately made. Each of the ten tribes furnished 1000 foot soldiers with a commander at their head. To complete this number it was necessary to enrol the slaves (A.) No sooner were the troops assembled than they marched out of the city into the plain of Marathon, where the inhabitants of Platæa in Boeotia sent them a reinforcement of 1000 infantry.

Scarcely were the two armies in sight of each other, before Miltiades proposed to attack the enemy. Ariftides and several of the commanders warmly supported this measure: but the rest, terrified at the excessive disproportion of the armies, were desirous of waiting for the succours from Lacedæmon. Opinions being divided, they had recourse to that of the polemarch, or chief of the militia, who was consulted on such occasions, to put an end to the equality of suffrages. Miltiades addressed himself to him, with the ardour of a man deeply impressed with the importance of present circumstances: "Athens (said he to him) is on the point of experiencing the greatest of vicissitudes. Ready to become the first power of Greece, or the theatre of the tyranny and fury of Hippias, from you alone, Callimachus, she now awaits her destiny. If we suffer the ardour of the troops to cool, they will shamefully bow beneath the Persian yoke; but if we lead them on to battle, the gods and victory will favour us. A word from your mouth must now precipitate your country into slavery or preserve her liberty." Callimachus gave his suffrage, and the battle was resolved. To ensure success, Ariftides, and the other generals after his example, yielded to Miltiades the honour of the command which belonged to them in rotation: but, to secure them from every hazard, he preferred waiting for the day which of right placed him at the head of the army.

When that day arrived, Miltiades drew up his troops at the foot of a mountain, on a spot of ground scattered over with trees to impede the Persian cavalry. The Platæans were placed on the left wing; Callimachus commanded the right; Ariftides and Themistocles were in the centre of the battle, and Miltiades every where. An interval of nearly a mile separated the Grecian army from that of the Persians. At the first signal the Greeks advanced over this space running. The Persians, astonished at a mode of attack so novel to both nations, for a moment remained motionless; but to the impetuous fury of the enemy they soon opposed a more sedate and not less formidable fury. After an obstinate conflict of some hours, victory began to declare herself in the two wings of the

(A) *Travels of Anacharsis*; authority, *Pausan.* i. 79. But Dr Gillies seems to think that the armed slaves were not included in the 10,000; but amounted of themselves to a greater number, and which formed the centre of the battle.

Marathon. the Grecian army. The right dispersed the enemy in the plain, while the left drove them back on a morass that had the appearance of a meadow, in which they stuck fast and were lost. Both these bodies of troops now flew to the succour of Aristides and Themistocles, ready to give way before the flower of the Persian troops placed by Datis in the centre of his battle. From this moment the rout became general. The Persians, repulsed on all sides, found their only asylum in the fleet which had approached the shore. The conquerors pursued them with fire and sword, and took, burnt, or sunk the greater part of their vessels: the rest escaped by dint of rowing.

The Persian army lost about 6400 men; that of the Athenians 192. Miltiades was wounded; Hippas was left dead on the field, as were Stefileus and Callimachus, two of the Athenian generals. Scarcely was the battle over, when a soldier worn out with fatigue forms the project of carrying the first news of so signal a success to the magistrates of Athens, and without quitting his arms, he runs, flies, arrives, announces the victory, and falls dead at their feet.

This battle was fought on the 6th of Boedromion, in the third year of the 72 Olympiad (or 29th September anno 490 B. C.). The next day 2000 Spartans arrived. In three days and nights they had marched 1200 stadia. Though informed of the defeat of the Persians, they continued their march to Marathon, nor did they enviously shun to behold those fields where a rival nation had signalized itself by so heroic an action: they there beheld the tents of the Persians still standing, the plain strewed over with dead, and covered with costly spoils: they there found Aristides, who with his tribe was guarding the prisoners and booty; and did not retire until they had bestowed just applauses on the victors.

The Athenians neglected nothing to eternise the memory of those who fell in the battle. It had been usual to inter the citizens who perished in war, at the public expence, in the Ceramicus without the city; but the death of these was deemed uncommonly meritorious. They were buried, and a barrow was made for them, where their bravery had been manifested. Their names were engraven on half columns erected on the plain of Marathon. These monuments, not excepting those of the generals Callimachus and Stefileus, were in a style of the greatest simplicity. In the intervals between them were erected trophies bearing the arms of the Persians. An artist of eminence had painted all the circumstances of the battle in one of the most frequented porticoes of the city: Miltiades was there represented at the head of the generals, and in the act of exhorting the troops to fight for their country.

Pausanias examined the field of battle about 600 years after this event. His account of it is as follows. "The barrow of the Athenians is in the plain, and on it are pillars containing the names of the dead under those of the tribes to which they belonged; and there is another for the Plataeans and slaves; and a distinct monument of Miltiades the commander, who survived this exploit. There may be perceived nightly the neighing of horses and the clashing of arms. No person has derived any good from waiting on purpose to behold the spectres; but their anger does not fall

on any one who happens to see them without design. The Marathonians worship those who were slain in the battle, styling them *heroes*.—A trophy also of white marble has been erected. The Athenians say the Medes were buried, religion requiring that the corpse of a man be covered with earth; though I was not able to find any place of sepulture; for there is no barrow or other sign visible, but they threw them promiscuously into a pit.—Above the lake are the marble mangers of the horses of Artaphernes, with marks of a tent on the rocks."

Many centuries have elapsed since the age of Pausanias; but the principal barrow, it is likely that of the gallant Athenians, still towers above the level of the plain. It is of light fine earth, and has a bush or two growing on it. Dr Chandler informs us that he enjoyed a pleasing and satisfactory view from the summit; and looked, but in vain, for the pillars on which the names were recorded, lamenting that such memorials should ever be removed. At a small distance northward is a square blement of white marble, perhaps part of the trophy. A Greek church has stood near it; and some stones and rubbish, disposed so as to form an open place of worship, remain.

MARATTA. See **MARHATTAS.**

MARATTI (Carlo), a celebrated painter, was born at Camorano, near Ancona, in 1625. He came a poor boy to Rome, when only 11 years old; and at 12 recommended himself so effectually to Andrea Sacchi, by his drawings after Raphael in the Vatican, that he took him into his school, where he continued 25 years till his master's death. His graceful and beautiful ideas occasioned his being generally employed in painting madonas and female saints. No man ever performed in a better style, or with a greater elegance. From the finest statues and pictures, he made himself master of the most perfect forms, and the most charming airs of heads, which he sketched with equal ease and grace. He has produced a noble variety of draperies, more artfully managed, more richly ornamented, and with greater propriety than even the best of the moderns. He was inimitable in adorning the head, in the disposal of the hair, and the elegance of his hands and feet, which are equal to those of Raphael; and he particularly excelled in gracefulness. In his younger days he etched a few prints, as well of his own invention as after others, with equal spirit and correctness. It would be endless to recount the celebrated paintings done by this great man. Yet he executed nothing slightly, often changed his design, and almost always for the better, whence his pictures were long in hand. By the example of his master, he made several admirable portraits of popes, cardinals, and other people of distinction, from whom he received the highest testimonies of esteem, as he likewise did from almost all the monarchs and princes of Europe. Innocent XI. appointed him keeper of the paintings in his chapel and the Vatican. Maratti erected two noble monuments for Raphael and Hannibal, at his own expence, in the Pantheon. How well he maintained the dignity of his profession, appears by his answer to a Roman prince, who complaining of the excessive price of his pictures, he told him there was a vast debt due from the world to the famous artists his predecessors, and that he, as their rightful successor, was come to claim

MARATTA,
Maratti.

Marauding
 ||
 Marble.

Marble.

claim those arrears. His abilities in painting were accompanied with many virtues, and particularly with an extensive charity. This great painter died at Rome in 1713, in the 88th year of his age.

MARAUDING, in a military sense, means a party of soldiers, who, without any order, go into the neighbouring houses and villages, when the army is either in camp or garrison, to plunder and destroy, &c. Marauders are a disgrace to the camp, to the military profession, and deserve no better quarter from their officers than they give to poor peasants, &c.

MARAVEDI, a little Spanish copper coin, worth somewhat more than a French denier, or half a farthing English.

The Spaniards always count by maravedis, both in commerce and in their finances, though the coin itself is no longer current among them. Sixty-three maravedis are equivalent to a rial of silver; so that the piasler, or piece of eight rials, contains 504; and the pistole of four pieces of eight, 2016 maravedis.

This smallness of the coin produces vast numbers in the Spanish accounts and calculation; inasmuch that a stranger or correspondent would think himself indebted several millions for a commodity that cost but a few pounds.

In the laws of Spain, we meet with several kinds of maravedis; Alphonsine maravedis, white maravedis, maravedis of good money, maravedis Combreños, black maravedis, and old maravedis. When we find maravedis alone, and without any addition, it is to be understood of those mentioned above. The rest are different in value, fineness of metal, time, &c. Mariana asserts, that this coin is older than the Moors; that it came from the Goths; that it was anciently equal to a third part of the rial, and consequently of 12 times the value of the present maravedi. Under Alphonsus XI. the maravedi was 17 times, under Henry II. ten times, under Henry III. five times, and under John II. two times and an half, the value of the present maravedi.

MARBELLA, a town of Andalusia in Spain, situated at the mouth of the Rio Verde, 30 miles north-east of Gibraltar, and 28 south-west of Malaga. W. Long. 5. 25. N. Lat. 30. 25.

MARBLE, in natural history, a genus of fossils; being bright and beautiful stones composed of small separate concretions, moderately hard, not giving fire with steel, fermenting with and soluble in acid menstrua, and calcining in a slight fire.—The word comes from the French *marbre*, and that from the Latin *marmor*, of the Greek *μαρμαριον*, to “shine or glitter.”

The colours by which marbles are distinguished are almost innumerable; but the most remarkable are, 1. The black marble of Flanders. 2. Plain yellow. 3. Yellow with some white veins. 4. Yellow with black dendrites. 5. Yellow with brown figures resembling ruins. 6. Black and yellow. 7. Black and white. 8. Pale yellow, with spots of a blackish-grey colour. 9. Yellow, white, and red. 10. Pale yellow. 11. Olive colour, with deeper coloured cross lines, and dendrites. 12. Brownish red. 13. Flesh-coloured and yellow. 14. Common red marble. 15. Crimson, white, and grey. 16. Reddish-brown lumps, on a whitish ground. 17. Bluish grey. 18. Snowy-white.

The varieties of marble, numerous as they are, have

been improperly augmented by virtuosos, and some people who collect specimens for the sake of gain. The Italians are particularly curious in this way; and most of the names inscribed upon marbles are given by them. Every marble brought from an unknown place is called by them *antico*; when distinguished by a number of bright colours, it is called *breccello*, or *brecciatelato*. When they want some of the originals to complete a whole set of marbles, they either substitute others which have the nearest resemblance to them; or, lastly, they stain white marbles according to their own fancy, and impose them on the world as natural. The finest solid modern marbles are those of Italy, Blankenburg, France, and Flanders. It has also been lately discovered, that very fine marble is contained in some of the Western Islands of Scotland. Those of Germany, Norway, and Sweden, are of an inferior kind, being mixed with a kind of scaly limestone; and even several of those above mentioned are partly mixed with this substance, though in an inferior degree. Cronstedt, however, mentions a new quarry of white marble in Sweden, which, from the specimens he had seen, promised to be excellent.

The specific gravity of marble is from 2700 to 2800; that of Carrara, a very fine Italian marble, is 2717.—Black marble owes its colour to a slight mixture of iron. Mr Bayen found some which contained 5 per cent. of the metal; notwithstanding which, the lime prepared from it was white, but in time it acquired an ochry or reddish-yellow colour.

Marble, when chemically examined, appears to consist of calcareous earth united with much fixed air; and is, like limestone or chalk, capable of being converted into a strong quicklime.—Dr Black derives the origin of marbles, as well as limestone and marble, from the same source, *viz.* from the calcareous matter of shells and lithophyta. In one kind of limestone known by the name of *Portland-stone*, and consisting of round grains united together, it was supposed to be composed of the spawn of fish; but comparisons of other phenomena have explained it. It is plain that it has been produced from a calcareous sand, which is found on the shore of some of the islands in the southern climates. By the constant agitation the softer parts are worn off, and the harder parts remain in the form of particles that are highly polished, and which are afterwards gradually made to concrete together by causes of which we have yet no knowledge.—There are indeed some few of the limestones and marbles in which we cannot discover any of the relics of the shells; but there are many signs of their having been in a dissolved or liquified state; so we cannot expect to see the remains of the form of the shells: but even in many of the marbles that have the greatest appearance of a complete mixture, we still find often the confused remains of the shells of which they have been originally composed. We should still find it difficult to conceive how such masses should have derived their origin from shells; but, considering the many collections that we have an opportunity of seeing in their steps towards this process, and a little concreted together, so that by their going a step farther they might form limestone and marbles, we shall soon see the possibility of their being all produced in the same manner. Thus vast quantities

Marble

titles of shells have been found in the province of Turrin in France; and indeed there is no place where they have not been found. The lithophyta likewise seem to be a very fruitful source of this kind of earth. In the cold climates, where the moderate degree of heat is not so productive of animal-life, we have not such an opportunity of observing this: but in the hot climates, the sea, as well as the land, swarms with innumerable animals; and, at the bottom, with those that produce the corals and madriporæ. We learn from the history of a ship that was sunk in a storm in the Gulf of Mexico, the vast growth there is of these bodies. About 30 years after, they attempted to dive into it to get out a quantity of silver; but they found great difficulty in getting it, from the ship being overgrown with coral. Sir Hans Sloan, in the Philosophical Transactions, and in his history of Jamaica, observes, that the ship's timber, the iron, and money, were all covered by the growth of the calcareous matter. So in a tract of many thousands of years the quantity of it should be very great; and as this is going on through a very great extent of the bottom of the sea, it will produce very extensive as well as massy collections of calcareous matter.

† Phil.
Traas; vol.
liiii. 12.

According to Sir William Hamilton †, many variegated marbles and precious stones are the produce of volcanoes.

Artificial MARBLES. The stucco, whereof they make statues, busts, basso-reliefs, and other ornaments of architecture, ought to be marble pulverized, mixed in a certain proportion with plaster; the whole well sifted, worked up with water, and used like common plaster. See STUCCO.

There is also a kind of artificial marble made of the flaky scapolites, or a transparent stone resembling plaster; which becomes very hard, receives a tolerable polish, and may deceive a good eye. This kind of scapolites resembles Muscovy talc.

There is another sort of artificial marble formed by corrosive tinctures, which, penetrating into white marble to the depth of a line or more, imitate the various colours of other dearer marbles.

There is also a preparation of brimstone in imitation of marble.

To do this, you must provide yourself with a flat and smooth piece of marble; on this make a border by wall, to encompass either a square or oval table, which may be done either with wax or clay. Then having several sorts of colours, as white lead, vermilion, lake, orpiment, masticot, snails, Prussian blue, &c. melt on a slow fire some brimstone in several glazed pipkins; put one particular sort of colour into each, and stir it well together; then having before oiled the marble all over within the wall, with one colour quickly drop spots upon it of larger and less size; after this, take another colour and do as before, and so on till the stone is covered with spots of all the colours you design to use. When this is done, you are next to consider what colour the mafs or ground of your table is to be; if of a grey colour, then take fine sifted ashes, and mix it up with melted brimstone; or if red, with English red ochre; if white, with white lead; if black, with lamp or ivory black. Your brimstone for the ground must be pretty hot, that the co-

Marble

loured drops on the stone may unite and incorporate with it. When the ground is poured even all over, you are next, if judged necessary, to put a thin wainscot board upon it; this must be done whilst the brimstone is hot, making also the board hot which ought to be thoroughly dry, in order to cause the brimstone to stick the better to it. When the whole is cold, take it up, and polish it with a cloth and oil, and it will look very beautiful.

Elastic MARBLE, an extraordinary species of fossil which has surprised all the naturalists who have seen it. There are several tables of it preserved in the house of Prince Borghese at Rome, and shown to the curious. F. Jaquer, a celebrated mathematician, has given a description in the Literary Gazette of Paris, but the naturalists cannot be contented with it. If permission was given to make the requisite experiments, this curious phenomenon might be better illustrated. There are five or six tables of that marble; their length is about two feet and a half, the breadth about ten inches, and the thickness a little less than three. They were dug up, as the Abbé Fortis was told, in the feed of Mondragone; the grain is of Carrarese marble, or perhaps of the finest Greek. They seem to have suffered some attack of fire: though the first degree of pulverization observable in the angles, can, perhaps, scarcely be called that of imperfect calcination. They are very dry, do not yield to external impression, rebound to the hammer, like other congenerous marble, and are perhaps susceptible of a polish. Being set on end, they bend, oscillating backward and forward; when laid horizontally, and raised at one end, they form a curve, beginning towards the middle; if placed on a table, and a piece of wood or any thing else is laid under them, they make a salient curve, and touch the table with both ends. Notwithstanding this flexibility, they are liable to be broken if indifferently handled; and therefore one table only, and that not the best, is shown to the curious. Formerly they were all together in the prince's apartment on the ground-floor.

Colouring of MARBLE. This is a nice art; and, in order to succeed in it, the pieces of marble on which the experiments are tried, must be well polished, and free from the least spot or vein. The harder the marble is, the better will it bear the heat necessary in the operation; therefore alabaster and the common soft white marble are very improper for performing these operations upon.

Heat is always necessary for opening the pores of marble, so as to render it fit to receive the colours; but the marble must never be made red-hot; for then the texture of it is injured, and the colours are burnt, and lose their beauty. Too small a degree of heat is as bad as one too great; for, in this case, though the marble receives the colour, it will not be fixed in it, nor strike deep enough. Some colours will strike even cold; but they are never so well sunk in as when a just degree of heat is used. The proper degree is that which, without making the marble red, will make the liquor boil upon its surface. The menstrums used to strike in the colours must be varied according to the nature of the colour to be used. A lixivium made with horse's or dog's urine, with four parts of quick-

lime

Marble.

line and one of pot-ashes, is excellent for some colours; common ley of wood-ashes is very good for others; for some, spirit of wine is best; and lastly, for others, oily liquors, or common white-wine.

The colours which have been found to succeed best with the peculiar menstrua, are these. Stone-blue dissolved in six times the quantity of spirit of wine, or of the urinous lixivium, and that colour which the painters call *limas*, dissolved in common ley of wood-ashes. An extract of saffron, and that colour made of buckthorn berries, and called by painters *sap green*, both succeed well when dissolved in urine and quicklime; and tolerably well when dissolved in spirit of wine. Vermilion, and a very fine powder of cochineal, also succeed very well in the same liquors. Dragon's-blood succeeds in spirit of wine, as does also a tincture of logwood in the same spirit. Alkanet-root gives a fine colour: but the only menstruum to be used for it is oil of turpentine; for neither spirit of wine, nor any lixivium, will do with it. There is another kind of *sanguis draconis*, commonly called *dragon's-blood in tears*, which, mixed with urine, gives a very elegant colour.

Beside these mixtures of colours and menstrua, there are other colours which must be laid on dry and unmixed. These are, dragon's-blood of the purest kind, for a red; gamboge for a yellow; green wax, for a green; common brimstone, pitch, and turpentine, for a brown colour. The marble for these experiments must be made considerably hot, and then the colours are to be rubbed on dry in the lump. Some of these colours, when once given, remain immutable, others are easily changed or destroyed. Thus, the red colour given by dragon's-blood, or by a decoction of logwood, will be wholly taken away by oil of tartar, and the polish of the marble not hurt by it.

A fine gold colour is given in the following manner: Take crude sal ammoniac, vitriol, and verdigrise, of each equal quantities. White vitriol succeeds best; and all must be thoroughly mixed in fine powder.

The staining of marble to all the degrees of red or yellow, by solutions of dragon's-blood or gamboge, may be done by reducing these gums to powder, and grinding them with the spirit of wine in a glass mortar. But, for smaller attempts, no method is so good as the mixing a little of either of those powders with spirit of wine in a silver spoon, and holding it over burning charcoal. By this means a fine tincture will be extracted; and, with a pencil dip in this, the finest traces may be made on the marble while cold; which, on the heating of it afterwards, either on sand, or in a baker's oven, will all sink very deep, and remain perfectly distinct on the stone. It is very easy to make the ground-colour of the marble red or yellow by this means, and leave white veins in it. This is to be done by covering the places where the whiteness is to remain with some white paint, or even with two or three doubles only of paper; either of which will prevent the colour from penetrating. All the degrees of red are to be given to marble by this gun alone; a slight tincture of it, without the assistance of heat to the marble, gives only a pale flesh colour: but the stronger tinctures give it yet deeper; to this the

Marble.

Marbled.

assistance of heat adds greatly; and finally, the addition of a little pitch to the tincture, gives it a tendency to blackness, or any degree of deep red that may be desired.

A blue colour may be given also to marble by dissolving turnfol in lixivium, in lime and urine, or in the volatile spirit of urine; but this has always a tendency to purple, whether made by the one or the other of these ways. A better blue, and used in an easier manner, is furnished by the Canary turnfol, a substance well known among the dyers. This needs only to be dissolved in water, and drawn on the place with a pencil: it penetrates very deeply into the marble; and the colour may be increased, by drawing the pencil wetted afresh several times over the same lines. This colour is subject to spread and diffuse its self irregularly; but it may be kept in regular bounds, by circumscribing its lines with beds of wax, or any such substance. It is also to be observed, that this colour should always be laid on cold, and no heat given even afterwards to the marble: and one great advantage of this colour is, that it is therefore easily added to marbles already stained with other colours, is a very beautiful tinge, and lasts a long time.— See also CHEMISTRY, p. 753.

Arundel MARBLES, marble with a chronicle of the city of Athens, inscribed on them (as was supposed) many years before our Saviour's birth; presented to the university of Oxford by Thomas earl of Arundel, whence the name. See *ARUNDELIAN Marbles*.

MARBLED, something veined or clouded, resembling marble. See MARBLING.

MARBLED China-ware, a name given by many to a species of porcelain or china-ware, which seems to be full of cemented flaws. It is called by the Chinese, who are very fond of it, *tsou tchi*. It is generally plain white, sometimes blue, and has exactly the appearance of a piece of China which had been first broken, and then had all the pieces cemented in their places again, and covered with the original varnish. The manner of preparing it is easy, and might be imitated with us. Instead of the common varnish of the China-ware, which is made of what they call *oil of stone* and *oil of fern* mixed together, they cover this with a simple thing made only of a sort of coarse agates, calcined to a white powder, and separated from the grosser parts by means of water, after long grinding in mortars. When the powder has been thus prepared, it is left moist, or in form of a sort of cream, with the last water that is suffered to remain in it, and this is used as the varnish. Our crystal would serve full as well as those coarse agates, and the method of preparation is perfectly easy. The occasion of the singular appearance of this sort of porcelain is, that the varnish never spreads evenly, but runs into ridges and veins. These often run naturally into a sort of mosaic-work, which can scarce be taken for the effect of chance. If the marbled China be desired blue, they first give it a general coat of this colour, by dipping the vessel into a blue varnish; and when this is thoroughly dry, they add another coat of this agate-oil.

Playing MARBLES, are mostly imported from Holland; where it is said they are made by breaking the stone alabaster, or other substance, into pieces or chips

Marbling. of a suitable size; these are put into an iron mill which turns by water: there are several partitions with rasps within, cut floatways, not with teeth, which turn constantly round with great swiftness; the friction against the rasps makes them round, and as they are formed, they fall out of different holes, into which size or clance throws them. They are brought from Nuremberg to Rotterdam, down the Rhine, and from thence dispersed over Europe.

MARBLING, the method of preparing and colouring the marbled paper.

There are several kinds of marbled paper; but the principal difference of them lies in the forms in which the colours are laid on the ground: some being disposed in whirls or circumsolutions; some in jagged lengths; and others only in spots of a roundish or oval figure. The general manner of managing each kind is, nevertheless, the same; being the dipping the paper in a solution of gum-tragacanth, or, as it is commonly called, *gum-dragon*; over which the colours, previously prepared with ox-gall and spirit of wine, are first spread.

The peculiar apparatus necessary for this purpose, is a trough for containing the gum-tragacanth and the colours; a comb for dipping them in the figure usually chosen; and a burnishing stone for polishing the paper. The trough may be of any kind of wood; and must be somewhat larger than the sheets of paper for marbling which it is to be employed; but the sides of it need only rise about two inches above the bottom; for by making it thus shallow, the less quantity of the solution of the gum will serve to fill it. The comb may be also of wood, and five inches in length; but should have brass teeth, which may be about two inches long, and placed at about a quarter of an inch distance from each other. The burnishing stone may be of jasper or agate; but as those stones are very dear when of sufficient largeness, marble or glass may be used, provided their surface be polished to a greater degree of smoothness.

The implements being prepared, the solution of gum-tragacanth must be made, by putting a sufficient proportion of the gum, which should be white and clear from all foulnesses, into clean water, and letting it remain there a day or two, frequently breaking the lumps and stirring it till the whole shall appear dissolved and equally mixed with the water. The consistence of the solution should be nearly that of strong gum-water used in miniature-painting; and if it appear thicker, water must be added; or if thinner, more of the gum. When the solution is thus brought to a due state, it must be passed through a linen cloth; and being then put into the trough, it will be ready to receive the colours.

The colours employed for red are carmine, lake, rose-pink, and vermilion; but the two last are too hard and glaring, unless they be mixed with rose-pink or lake, to bring them to a softer cast; and with respect to the carmine and lake, they are too dear for common purposes: for yellow, Dutch pink and yellow ochre may be employed:—for blue, Prussian blue and verditer may be used:—for green, verdigrise, a mixture of Dutch pink and Prussian blue, or verditer, in different proportions:—for orange,

the orange-lake, or a mixture of vermilion, or red lead, with Dutch pink:—for purple, rose-pink and Prussian blue.

These several colours should be ground with spirit of wine till they be of a proper fineness; and then, at the time of using them, a little fish-gall, or in default of it the gall of a beast, should be added, by grinding them over again with it. The proper proportion of the gall must be found by trying them; for there must be just so much as will suffer the spots of colour, when sprinkled on the solution of the gum-tragacanth, to join together, without intermixing or running into each other.

When every thing is thus prepared, the solution of the gum-tragacanth must be poured into the trough; and the colours, being in a separate pot, with a pencil appropriated to each, must be sprinkled on the surface of the solution, by shaking the pencil, charged with its proper colour, over it; and this must be done with the several kinds of colour desired, till the surface be wholly covered.

When the marbling is proposed to be in spots of a simple form, nothing more is necessary: but where the whirls or snail-shell figures are wanted, they must be made by means of a quill; which must be put among the spots to turn them about, till the effect be produced. The jagged lengths must be made by means of the comb above described, which must be passed through the colours from one end of the trough to the other, and will give them that appearance: but if they be desired to be pointed both ways, the comb must be again passed through the trough in a contrary direction; or if some of the whirls or snail-shell figures be required to be added, they may be yet made by the means before directed.

The paper should be previously prepared for receiving the colours, by dipping it over-night in water; and laying the sheets on each other with a weight over them. The whole being thus ready, the paper must be held by two corners, and laid in the most gentle and even manner on the solution covered with the colours; and there softly pressed with the hand, that it may bear every-where on the solution. After which it must be raised and taken off with the same care, and then hung to dry across a proper cord, subtended near at hand for that purpose: and in that state it must continue till it be perfectly dry. It then remains only to give the paper a proper polish: in order to which, it is first rubbed with a little soap; and then must be thoroughly smoothed by the glass polishers, such as are used for linen, and called the *cadender glasses*. After which it should be again rubbed by a burnisher of jasper or agate; or, in default of them, of glass ground to the highest polish: for on the perfect polish of the paper depends in a great measure its beauty and value.

Gold or silver powders may be used, where desired, along with the colour; and require only the same treatment as them, except that they must be first tempered with gum-water.

Marbling of books or paper is performed thus: Dissolve four ounces of gum-arabic into two quarts of fair water; then provide several colours mixed with water in pots or shells; and, with pencils peculiar to each

Marbling.

each colour, sprinkle them by way of intermixture upon the gum-water, which must be put into a trough or some broad-vessel; then with a stick curl them, or draw them out in streaks, to as much variety as may be done. Having done this, hold your book or books close together, and only dip the edges in, on the top of the water and colours, very lightly; which done, take them off, and the plain impression of the colours in mixture will be upon the leaves; doing as well the ends as the front of the book in the like manner.

Marbling a book on the covers is performed by forming clouds with aqua-fortis or spirit of vitriol mixed with ink, and afterwards glazing the covers. See the article BOOK-BINDING.

MARCA-ANTONIO. See RAIMONDI.

MARCA (Peter de), one of the greatest ornaments of the Gallican church, was born in Bearn, of an ancient family, in 1504. He first studied the law, was made president of the parliament of Bearn, and, going to Paris in 1639, was made a counsellor of state: the good opinion entertained of his knowledge was confirmed by his *History of Bearn*. By the king's order he published a work, *De concordia sacerdotii et imperii, sive de libertatibus ecclesie Gallicae*, in refutation of a book that appeared under the title of *Optatus Gallus*; and on this account, when on the death of his wife he was nominated bishop of Conserans, the court of Rome refused the bulls in his favour, until by another book he explained away all he had said on behalf of the state, to the limitation of the papal power. He obtained his confirmation, after seven years suspense, in 1648; was translated to the archbishopric of Toulouse in 1652; and was made minister of state in 1659. He died at Paris in 1662, a short time after he had received the bulls as the archbishop of that metropolis. After his death appeared his *Posthumous works*, with prefaces, notes, &c. by M. Baluze. In all he wrote, he showed great abilities and learning, but is reproached for accommodating them to his views of interest and ambition.

MARCASITE, in mineralogy. This name has long been given indifferently to all sorts of minerals; to ores, pyrites, and to semimetals. Lately, it seems to be confined to pyrites, and Wallerius proposes to confine it to such pyrites as are regularly formed. This seems to be better than to leave it a vague and indeterminate signification, on account of the ambiguity and obscurity which might thereby be introduced. See PYRITES.

MARCELLIANISM, the doctrines and opinions of the Marcellians, a sect of ancient heretics, towards the close of the second century, so called from Marcellus of Ancyra, their leader, who was accused of reviving the errors of Sabellius. Some, however, are of opinion, that Marcellus was orthodox, and that they were his enemies the Arians, who fathered their errors upon him. St Epiphanius observes, that there was a great deal of dispute with regard to the real tenets of Marcellus; but that, as to his followers, it is evident they did not own the three hypostases: for Marcellus considered the Son and Holy Ghost as two emanations from the divine nature, which, after performing their respective offices, were to return again into the substance of the Father; and this opinion is

altogether incompatible with the belief of three distinct persons in the Godhead.

MARCELLINUS (Amnianus.) See AMMIANUS. MARCELLO (Benedict), a celebrated musician, and descended from one of the most illustrious families in Venice. He lived in the beginning of the present century. We have of his composition, anthems, cantatas, and other works, which the connoisseurs rank as high as any of the numerous and excellent musical compositions which the Italian school has produced. "He is the Pindar of music, (says M. de la Borde). In boldness and regularity of design, he is the Michael Angelo of it. In analysing his works, we discover a profound knowledge and great address; but there is a difficulty attending the execution of them which is almost insurmountable. It requires a voice possessed of great powers, and accustomed to the most extraordinary intervals." The chief of the family which still exists was the ambassador of Venice to the Porte in 1770.

MARCELLUS (Marcus Claudius), a famous Roman general, who, after the first Punic war, had the management of an expedition against the Gauls. Here he obtained the *Spolia opima*, by killing with his own hand Viridomarus the king of the enemy. Such success rendered him popular, and soon after he was entrusted to oppose Hannibal in Italy. He was the first Roman who obtained some advantage over this celebrated Carthaginian, and showed his countrymen that Hannibal was not invincible. The troubles which were raised in Sicily by the Carthaginians at the death of Hieronymus, alarmed the Romans; and Marcellus, in his third consulship, was sent with a powerful force against Syracuse. He attacked it by sea and land; but his operations proved long ineffectual, and the invention and industry of Archimedes were able to baffle all the efforts, and to destroy all the great and stupendous machines and military engines of the Romans during three successive years. The perseverance of Marcellus at last obtained the victory. After this conquest, Marcellus was called upon by his country to oppose a second time Hannibal. In this campaign he behaved with greater vigour than before; the greatest part of the towns of the Samnites, which had revolted, were recovered by force of arms, and 3000 of the soldiers of Hannibal made prisoners. Some time after, in an engagement with the Carthaginian general, Marcellus had the disadvantage; but on the morrow a more successful skirmish vindicated his military character and the honour of the Roman soldiers. Marcellus, however, was not sufficiently vigilant against the snares of his adversary. He imprudently separated himself from his camp, and was killed in an ambuscade, in the 60th year of his age, in his 5th consulship, A. U. C. 544. His body was honoured with a magnificent funeral by the conqueror, and his ashes were conveyed in a silver urn to his son. Marcellus claims our commendation for his private as well as public virtues; and the humanity of a general will ever be remembered, who, at the surrender of Syracuse, wept on the thought that many were going to be exposed to the avarice and rapaciousness of an incensed soldiery, which the policy of Rome and the laws of war rendered inevitable.

MARGRAVE, or MARGRAVE, a kind of dignity

Marcellinus
Margrave.

March.

nity in Germany, answering to our *marquis*; (see *MARQUIS*.) The word is derived from the German *Marche*, or *Mark*; which signifies "a frontier;" and *Graffe*, "count, governor;" *Maregraves* being originally governors of cities lying on the frontiers of a country or state.

MARCH, MARTIUS, the third month of the year, according to the common way of computing. See MONTH, and YEAR.

Among the Romans, March was the first month; and in some ecclesiastical computations, that order is still preserved; as particularly reckoning the number of years from the incarnation of our Saviour; that is, from the 15th of March.

It was Romulus who divided the year into months; to the first of which he gave the name of his supposed father *Mars*. Ovid, however, observes, that the people of Italy had the month of March before Romulus's time; but that they placed it very differently, some making it the third, some the fourth, some the fifth, and others the tenth month of the year.

In this month it was that the Romans sacrificed to Anna Perenna; that they begun their comitia; that they adjudged their public farms and leases; that the mistresses served the slaves and servants at table, as the masters did in the Saturnalia; and that the vestals renewed the sacred fire.

The month of March was always under the protection of Minerva, and always consisted of 31 days.—The ancients held it an unhappy month for marriage, as well as the month of May.

MARCH, in the military art, is the moving of a body of men from once place to another. Nothing is laid down particularly concerning the marches of the Jewish armies; only thus much we may collect, that they made use of trumpets, to the different sounds of which they prepared themselves by packing up their baggage, putting themselves in readiness, and attending at the standards, to wait the signal for marching. We are told that the army of the Israelites marched in general no more than one league in a day and an half; but this appears to hold good only of their progress through difficult road: For Follard says they might, in an open country, march four leagues in a day or more. The Rabbits suppose that the Israelites marched in the same order they were placed in their camp. The Greeks, let the posture of their affairs be what it would, never marched against their enemies till favourable omens encouraged the enterprise. An eclipse of the moon, or any untoward accident, or the intervening of what they esteemed an unlucky day, entirely prevented their march. But of all the Greeks the Lacedemonians were the most nice and scrupulous. The heavenly bodies directed all their motions; and it was an invariable maxim with them never to march before the full moon. The Greeks are particularly remarked by Homer for marching in good order and profound silence; whereas the Barbarian forces were all noise, clamour, and confusion. It is needless to say any thing concerning the marches of the Roman armies, more than that they were performed with the greatest order and dispatch, inasmuch that their unexpected presence frequently

damped the spirits of their enemies. The Roman soldiers were enured to the military pace, that is, to walk 20 miles in five hours, though at the same time they carried burdreas of sixty pounds weight.

Of all the mechanical parts of war, in modern times, none is more essential than that of marching. It may be justly called the *key* which leads to all sublime motions and manœuvres of an army; for they depend entirely on this point. A man can be attacked in four different ways; in the front, on both flanks, and in the rear: but he can defend himself, and annoy the enemy, only when placed with his face towards him. Hence it follows, that the general object of marching is reduced to three points only; to march forwards, and on both sides, because it is impossible to do it for any time backwards, and by that means face the enemy wherever he present himself.—The different steps to be made use of are three; slow, fast, and oblique. The first is proper in advancing, when at a considerable distance from the enemy, and when the ground is unequal, that the line may not be broke, and a regular fire kept up without intermission. The second is chiefly necessary when you want to anticipate the enemy in occupying some post, in passing a defile, and, above all, in attacking an entrenchment, to avoid being a long while exposed to the fire of the artillery and small arms, &c. The third step is of infinite consequence, both in the infantry and cavalry; columns may be opened and formed into lines, and, *vice versa*, lines into columns, by this kind of step, in a lesser space, and consequently in less time, than by any other method whatsoever. In coming out of a defile, you may instantly form the line without presenting the flank to the enemy. The line may be formed, though ever so near to the enemy, with safety, because you face him, and can with ease and safety protect and cover the motion of the troops, while they are coming out of the defiles, and forming. The same thing may be equally executed, when a column is to be formed in order to advance or retreat; which is a point of infinite consequence, and should be established as an axiom.

The order of march of the troops must be so disposed, that each should arrive at their rendezvous, if possible, on the same day. The quarter-master-general, or his deputy, with an able engineer, should sufficiently reconnoitre the country, to obtain a perfect knowledge of it and the enemy, before he forms his routes.

Before a march, the army generally receives several days bread. The quarter-masters, camp colour-men, and pioneers, parade according to orders, and march immediately after, commanded by the quarter-master-general or his deputy. They are to clear the roads, level the ways, make preparations for the march of the army, &c. The *general*, for instance, beats at 2, the *assembly* at 3, and the army to march in 20 minutes after. Upon beating the *general*, the village, and general officer's guards, quarter and rear-guards, join their respective corps; and the army pack up their baggage. Upon beating the *assembly*, the tents are to be struck, and sent with the baggage to the place appointed, &c.

March.

March,
Marchand.

The companies draw up in their several streets, and the rolls are called. At the time appointed, the drummers are to beat a march, and fifers play at the head of the line, upon which the companies march out from their several streets, form battalions as they advance to the head of the line, and then halt.

The several battalions will be formed into columns by the adjutant-general, and the order of march, &c. be given to the general officers who lead the columns.

The cavalry generally march by regiments or squadrons. The heavy artillery always keeps the great roads, in the centre of the columns, escorted by a strong party of infantry and cavalry. The field-pieces march with the columns.

Each soldier generally marches with 36 rounds of powder and ball, and 2 good flints; one of which is to be fixed in the cock of his firelock. The routes must be formed so that no columns cross one another on the march.

MARCHAND (John-Louis), a native of Lyons, who shares with the celebrated *d'Agui* the glory of having carried the art of playing on the organ to the highest degree of perfection. When very young he went to Paris; and happening to be in the chapel of the college of Louis the Great, when they were waiting for the organist to begin divine service, he offered himself in his place. His playing gave so great satisfaction, that the Jesuits kept him in the college, and supplied him with every necessary to perfect his talents. Marchand continued to play the organ of their chapel; and though many advantageous places were offered to him, he always refused to accept them. This disinterested conduct was not solely owing to his gratitude; for he was of so whimsical and independent a disposition of mind, that he was equally careless about reputation and glory. He died at Paris in 1732, at the age of 63. From him we have two books of Pieces for the Harpsichord, much esteemed by the connoisseurs.

MARCHAND (Professor), was from his youth brought up at Paris, in the profession of a bookseller, and in the knowledge of books. He kept a regular correspondence with several learned men, among whom was Bernard the continuator of the *Nouvelles de la Republique des Lettres*, and furnished this writer with the literary anecdotes of France. Marchand, having embraced the Protestant religion, went to join Bernard in Holland, where he might be at liberty to profess his religious opinions. He continued the trade of bookseller for some time; but afterwards quitted it, that he might dedicate himself wholly to the pursuits of literature. The history of France, together with a knowledge of books and authors, was always his favourite study. In the latter he was so eminently distinguished, that he was consulted from all parts of Europe. He was also one of the principal authors of the *Journal Littéraire*, one of the best periodical works which have appeared in Holland; and he furnished excellent extracts for the other journals. This valuable and learned man died at an advanced age, the 14th of June 1756; and left the little fortune which he had, to a society instituted at the Hague, for the education and instruction of a certain number of poor people. His library, which was excellently chosen for literary history, together with his manuscripts, was left by his

will to the university of Leyden. From him we have, 1. *The History of Printing*, a new edition of which has been promised by one of his friends. This work, which is full of notes and critical discussions, appeared in 1745 at the Hague, in 4to. There is such a prodigious display of erudition, and remarks and quotations are heaped together in such confusion, that when you get to the end of the chaos, you know not what conclusion to form concerning the points which have been discussed. Abbe Mercier, abbot of Saint-Leger de Soissons, gave, in 1775, 4to, a supplement to this history, which is equally curious and accurate. 2. An Historical Dictionary, or Memoirs Critical and Literary, printed at the Hague in 1758, in two small volumes, folio. In this work we meet with historical singularities, literary anecdotes, and a discussion of points of bibliography; but too great minuteness prevails in it, the style is deficient in point of purity, and the author is too much carried away by the heat and eagerness of his character. More erudition could not well be collected; especially upon subjects which, at least to the generality of readers, are so uninteresting. 3. A new edition of Bayle's Dictionary, and Letters of the *Cymbalum mundi*, &c.

MARCHANTIA, in botany: A genus of the natural order of algae, belonging to the cryptogamia class of plants. The male calyx is petalated, and covered below with monopetalous corollæ; the anthers are multifid; the female calyx is sessile, campanulate, and polyspermous. There are eight species; of which the most remarkable are, 1. The polymorpha, or great star-handed marchantia, is a native of Britain, growing on the banks of rivulets, on shady moist rocks, the sides of wells, and sometimes bogs. The leaves are about three inches long; from half an inch to an inch broad, lying flat on the ground, and adhering closely to it by numerous downy radicles, which grow out of the middle and base of the leaf on the under side. These leaves are situated on their edges, their upper surface of a dark, shining, green colour, reticulated with numerous, minute, rhomboidal, or lozenge-like scales; variously divided into obtuse lobes, and in the middle by a blackish purple vein; their under side is of a paler green, and their substance coriaceous, and nearly opaque. There are three varieties, from one of which is produced a yellow powder, showing a most curious and wonderful mechanism when examined by the microscope. The leaves have a strong aromatic smell, and acrid taste; and are recommended, in a decoction of skimmed milk, as good in the jaundice and other disorders of the liver. 2. The conica, or conic-mushroom marchantia, with warty leaves, grows on moist shady banks by the sides of rivulets. The leaves are broad, flat, about two inches long, dichotomous, obtusely lobed, and lie upon one another. Their surface is of a pale-green glossy colour, curiously tessellated with rhomboidal and hexagonal tubercles, each having a white vesicle or wart in the centre, with a puncture on its head. The leaves have a peculiar strong fragrant smell, and acrid aromatic taste. They are supposed to possess the same attenuating quality as the first, but in a higher degree. They are also recommended as an antiscorbutic, and for thinning the blood.

MARCHE, a province of France, bounded on the north-

Marchand
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Marche.

Marchena
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Marchius.

north by Berry, on the east by Auvergne, on the west by Angoumois, and on the south by Limosin. It is about 55 miles in length, and 25 in breadth, and is pretty fertile in corn and wine.

MARCHENA, an handsome, ancient, and considerable town of Spain, in Andalusia, with the title of a duchy, and a suburb as large as the town, seated in the middle of a plain, particularly fertile in olives, though very destitute of water. W. Long. 5. 20. N. Lat. 37. 20.

MARCHERS, or LORDS-MARCHERS, were those noblemen that lived on the marches of Wales or Scotland; who, in times past, according to Camden, had their laws, and *potestatem vitae*, &c. like petty kings, which are abolished by the stat. 27 H. 8. c. 26. and 1 Edw. 6. c. 10. In old records the lords marches of Wales were styled *Marchianes de Marchia Wallie*. See 1 & 2 P. & M. c. 15.

MARCHES (*marchia*), from the German *march*, i. e. *limes*, or from the French *marque*, viz. *signum*, (being the notorious distinction between two countries or territories), are the limits between England and Wales, or between England and Scotland, which last are divided into west and middle marches, 4 Hen. 5. c. 7. 22 Ed. 4. c. 8. 24 Hen. 8. c. 9. And there was formerly a court called the *court of the marches of Wales*, where pleas of debt or damages, not above the value of 50 pounds, were tried and determined; and if the council of the marches held pleas for debts above that sum, &c. a prohibition might be awarded. *Hill. 14. Car. 1. Cro. Car. 38.*

MARCHET, or MARCHETTA, a pecuniary fine, anciently paid by the tenant to his lord, for the marriage of one of the tenant's daughters. This custom obtained, with some difference, throughout all England and Wales, as also in Scotland; and it still continues to obtain in some places. According to the custom of the manor of Dinover in Caermarthenshire, every tenant at the marriage of his daughter pays ten shillings to the lord; which, in the British language, is called *gwabr-merched*, i. e. *maid's fee*.

In Scotland, and the north parts of England, the custom was, for the lord to lie the first night with the bride of his tenant: but this usage was abrogated by king Malcolm III. at the instance of his queen; and, instead thereof, a mark was paid by the bridegroom to the lord: whence it was called *marcbeta mulieris*. See *Borough-English*.

MARCIANA SILVA (anc. geog.), a forest situated between the Rauraci and the Danube, before it comes to be navigable; a part of the Hercynia. Now Schwartzwald, or *Black Forest*, in the south-west of Suabia, near the rise of the Danube and Neckar.

MARCIANUS, a native of Thrace, born of an obscure family. After he had for some time served in the army as a common soldier, he was made private secretary to one of the officers of Theodosius. His winning address and uncommon talents raised him to higher stations; and on the death of Theodosius II. A. D. 450, he was invested with the imperial purple in the east. The subjects of the Roman empire had reason to be satisfied with their choice. Marcianus showed himself active and resolute; and when Attila, the barbarous king of the Huns, asked of the empe-

Marcio-
nites.

ror the annual tribute, which the indolence and cowardice of his predecessors had regularly paid, the successor of Theodosius firmly said, that he kept his gold for his friends, but that iron was the metal which he had prepared for his enemies. In the midst of universal popularity Marcianus died, after a reign of six-years, in the 60th year of his age, as he was making warlike preparations against the barbarians that had invaded Africa. His death was long lamented; and indeed his merit was great, since his reign has been distinguished by the appellation of the golden age. Marcianus married Pulcheria the sister of his predecessor. It is said, that in the years of his obscurity he found a man who had been murdered, and that he had the humanity to give him a private burial; for which circumstance he was accused of the homicide, and imprisoned. He was condemned to lose his life; and the sentence would have been executed, had not the real murderer been discovered, and convinced the world of the innocence of Marcianus. — Another emperor of the east, A. D. 479, &c.

MARCIONITES, or MARCIONISTS, *Marcioniste*, a very ancient and popular sect of heretics, who, in the time of St Epiphanius, were spread over Italy, Egypt, Palestine, Syria, Arabia, Persia, and other countries: they were thus denominated from their author Marcion. Marcion was of Pontus, the son of a bishop, and at first made profession of the monastic life; but he was excommunicated by his own father, who would never admit him again into the communion of the church, not even on his repentance. On this he abandoned his own country, and retired to Rome, where he began to broach his doctrines.

He laid down two principles, the one good, the other evil: between these they imagined an intermediate kind of deity of a mixed nature, who was the creator of this inferior world, and the god and legislator of the Jewish nation: the other nations, who worshipped a variety of gods, were supposed to be under the empire of the evil principle. These two conflicting powers exercise oppressions upon rational and immortal souls; and therefore the supreme God, to deliver them from bondage, sent to the Jews a being more like unto himself, even his son Jesus Christ, clothed with a certain shadowy resemblance of a body: this celestial messenger was attacked by the prince of darkness, and by the god of the Jews, but without effect. Those who follow the directions of this celestial conductor, mortify the body by fastings and austerities, and renounce the precepts of the god of the Jews, and of the prince of darkness, shall after-death ascend to the mansions of felicity and perfection. The rule of manners which Marcion prescribed to his followers was excessively austere, containing an express prohibition of wedlock, wine, flesh, and all the external comforts of life.

Marcion denied the real birth, incarnation, and passion of Jesus Christ, and held them to be all apparent only. He denied the resurrection of the body; and allowed none to be baptized but those who preserved their continence; but these, he granted, might be baptized three times. In many things he followed the sentiments of the heretic Cerdon, and rejected the law and the prophets. He pretended the gospel had been

Marcites
Mare

corrupted by false prophets, and allowed none of the evangelists but St Luke, whom also he altered in many places as well as the epistles of St Paul, a great many things in which he threw out. In his own copy of St Luke he threw out the two first chapters entire.

MARCITES, MARCITE, a sect of heretics in the second century, who also called themselves the *perfecti*, and made profession of doing every thing with a great deal of liberty and without any fear. This doctrine they borrowed from Simon Magus, who however was not their chief; for they were called *Marcites* from one Marcus, who conferred the priesthood, and the administration of the sacraments, on women.

MARCO POLO, PAOLO, or *Paulo*. See PAULO. MARCOMANNI, an ancient people of Germany, who seem to have taken their name from their situation on the limits or marches, to the east of the Higher Rhine, and the north of the Danube. Cluverius allots to them the duchy of Wurtemberg, a part of the palatinate between the Rhine and the Neckar, the Brisgau, and a part of Suabia, lying between the springs of the Danube and the river Bregentz: they afterwards removed to the country of the Boii, whom they expelled and forced to withdraw more to the east, occupying what is now called *Bohemia*. (Strabo, Vel-leius.)

MARCOSIANS, or COLOBARSIANS, an ancient sect in the church, making a branch of the VALENTINIANS.

St Irenæus speaks at large of the leader of this sect, Marcus, who it seems was reputed a great magician. The Marcosians had a great number of apocryphal books which they held for canonical, and of the same authority with ours. Out of these they picked several idle fables touching the infancy of Jesus Christ, which they put off for true histories. Many of these fables are still in use and credit among the Greek monks.

MARCULUS, among the Romans, a knocker or instrument of iron to knock at the doors with.

MARCUS (Aurelius Antoninus). See ANTONINUS.

MARDIKERS, or TOPASSES, a mixed breed of Dutch, Portuguese, Indians, and other nations, incorporated with the Dutch at Batavia, in the East Indies.

MARE, the female of the horse kind. See the article EQUUS, and HORSE.

Before a mare is covered, she should be in the house about six weeks, during which time she should be well fed with good hay and oats well sifted; and in order to render her conception the more certain, near a quart of blood may be taken from each side of her neck, about five or six days before covering. Another method to bring a mare in season and make her retain, is to give her, for the space of eight days before you bring her to the horse, about two quarts of hemp-seed in the morning, and as much at night; and if she refuses to eat it, to mingle it with a little bran or oats, or else to let her fast for a while; and if the stallion also eat of it, it will greatly contribute to generation.

Mares go with foal 11 months, and as many days as they are years old; and therefore the properest

Vol. X. Part II.

Marcotis
Mare

time for covering them is in the beginning of June, that they may foal the May following, when there will be plenty of grass, which will afford the mares a great abundance of milk for nourishing their foals. After covering, let her, for three weeks or a month, have the same diet as before, and be kept clean in the stable, with her feet well pared and thin shod: If she cannot readily bring forth, hold her nostrils so as to stop her taking wind; and if that will not do, dissolve madder, to the quantity of a walnut, in a pint of ale and give it her warm. In case she cannot void her secundine, or after-burden, boil two or three handfuls of fennel in running water; then put half a pint of that liquor into as much sack, or, for want thereof, into a pint of ale, with a fourth part of salad-oil, mixed together, and pour it lukewarm into her nostrils, holding them close for some time. Otherwise, give her green wheat, or rye, the last of which is best.

If the mare has but little milk, boil as much as you can get from her with the leaves of lavender and spike, and bathe the udder with it warm, till the knobs and knots are dissolved. She should now drink only white water, which is bran put into water; give her also sweet mashes: and a month after foaling, let her have a mash with some brimstone or favin in it.

MAREOTIS, a lake in Egypt near Alexandria. Its neighbourhood was famous for wine; though some make the *Mareoticum virum* grow in Epirus, or in a certain part of Libya, called also *Mareotis*, near Egypt.

MARETS (Jean de), a Parisian, one of the finest geniuses of the 17th century, became at last a visionary and a fanatic. He was a great favourite of cardinal Richelieu, and possessed an employment of genius under him; for he was called upon to relax and divert him, after the fatigue of business, by facetious conversation. He used, in order to triumph over the virtue of women, when they objected to him the interest of their salvation, to lead them into atheistical principles. He was a member of the French academy from its first creation. He wrote several dramatic pieces, which were well received. He attempted an epic poem; but after spending several years about it, dropped the design to write books of devotion. He likewise wrote romances; but not such virtuous ones as used to be written at that time. He was a declared enemy of the Jansenists. His visions are well described by the *Messieurs* de Port Royal. He promised the king of France, by the explication of prophecies, the honour of overthrowing the Mahometan empire. In his last years he wrote something against Boileau's *Satires*.

MARETS (Samuel de), one of the most celebrated divines of the reformed church, was born in Picardy, in 1599. In 1620, he was settled in the church of Laon; but, in 1624, accepted a call to that of Sedan; in 1642, he obtained a professorship at Groningen; and, from that time to his death, exerted himself so much in the service of that university, that it was reckoned one of the most flourishing in the Netherlands. His System of Divinity was found to be so methodical, that it was made use of at other academies; and at the end of it may be found a chronological table of all his works. Their number is prodigious; and their

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Margaret. variety shows the extent of his genius. He was more-over engaged in many disputes and controversies, and died in 1673.

MARGARET (St), a celebrated virgin who, as is supposed, received the crown of martyrdom at Antioch in the year 275: the manner of her death is not known. The ancient martyrologists make no mention of her name, and she did not become famous till the 11th century. There is no more foundation for what is said concerning her relics and girdles than for the stories which are told of her life. A festival, however, is still held in honour of her memory on the 20th of July: See *Baile's Lives of the Saints* for that day. "Her actions (says this author) have been falsified and altered, in the opinion even of Metaphrasts, that the Romish church have not thought proper to infer any of them into their breviary. The Orientals pay reverence to her by the name of *Saint Pelagia* or *Saint Marina*, and the western church by that of *Saint Geruma* or *Saint Margaret*."

MARGARET, the daughter and heiress of Florent count of Holland, who is famous on account of a story repeated by a hundred compilers even of the present century. Having refused charity to a woman whom she at the same time accused of adultery, she was, as a punishment from God, brought to bed (A.D. 1276) of 365 children, partly boys and partly girls. The boys, it is added, were all named *John*, and the girls *Elizabeth*. This story is represented in a large painting in a village not far from the Hague; and by the side of the painting are seen two large basins of brass, on which it is pretended the 365 children were presented to be baptised. But if a picture is a sufficient authority for the truth of any thing, it is impossible to tell how many fables would be fully attested. It has been remarked, that the most ancient annals are altogether silent concerning this fact; and that it is related only by modern writers, who besides do not agree with one another concerning either the date of time, or the life of the counts, or the number of the children; and in short, that Nassau, who was at that time bishop of Utrecht, was called *John*, and not *Gul*, as the chronicles declare. Several learned men have endeavoured to trace the cause which could have given rise to a relation so extraordinary. M. Struik fixed upon the epitaphs of the mother and son, which appeared to him worthy of some attention; and, in conformity to the dates which they bear, he supposed that the counts were brought to bed on Good-Friday 1276, which was the 26th of March. Now, as the year then began on the 25th of the same month, there were only two days of the year elapsed when the counts were brought to bed, which circumstance caused it to be said that *she had brought into the world as many children as there were days in the year*. In fact only two children are mentioned in history, John and Elizabeth. The fable thus explained is only a common event, wherein there is nothing of the marvellous, but in consequence of a double meaning in the expression. Later writers, who have not examined this circumstance, have ascribed 365 children to the counts. (*Journal des Savans*, February, 1758, on the General History of the United Provinces.)

MARGARET (counts) of Richmond and Derby,

the learned and pious mother of Henry VII. was born Margaret. at Bethloe in Bedfordshire, in 1441; and was the sole heiress of John Beaufort duke of Somerset, grandson to John of Gaunt. Her mother was the heiress of Lord Beauchamp of Powick. Whilst yet very young, the great duke of Suffolk, minister to Henry VI. or rather to Queen Margaret, sought her in marriage to his son; and she was at the same time solicited by the king for his half-brother Edmund earl of Richmond. To the latter she gave her hand. Henry VII. was the sole fruit of this marriage, his father dying when he was but 15 weeks old. Her second husband was Sir Henry Stafford, knight, second son to the duke of Buckingham; by whom she had no issue. Soon after his death, which happened in the year 1482, she sought consolation in a third husband, Thomas Lord Stanley, who, in the first year of her son's reign, was created earl of Derby. He died in the year 1504, without issue, being then high constable of England. She survived her lord not quite five years, dying at Westminster in June 1509, in the 60th year of her age. She was buried in Henry VII.'s chapel; on the south side of which was erected to her memory an altar-tomb of black marble, with her statue of brass.

From her funeral sermon preached by her confessor-bishop Fisher, who, says Ballard, knew the very secrets of her soul, we learn, "that she possessed almost all things that were commendable in a woman, either in mind or body." She understood the French language perfectly, and had some knowledge of the Latin. She was devout even to austerity, in humility romantic, profuse in the encouragement of learning, and singularly chaste; but this last virtue became conspicuous only towards the latter end of a third marriage. "In her last husband's days (says Baker), she obtained a licence of him to live chaste, whereupon she took upon her the vow of celibacy." "A boon (says Mr Walpole), as seldom requested, I believe, of a third husband, as it probably would be easily granted." Her life, from the turbulence of the times, and vicissitude of her son's fortune, must necessarily have been subject to infinite disquiet, which however she is said to have supported with singular fortitude.—She wrote, 1. The mirror of golde for the sinful soule, translated from a French translation of a book called *Speculum aureum peccatorum*. Emprynted at London, in Fletesstrete, at the signe of St George, by Richard Pynfon, quarto, with cuts on vellum. 2. Translation of the fourth book of Dr Gersen's treatise of the imitation and following the blessed life of our most merciful Saviour Christ. Printed at the end of Dr Wm. Atkinson's English translation of the three first books, 1504. 3. A letter to the king; in Howard's collection. 4. By her son's order and authority, she also made the Orders for great estates of ladies and noble women, for their precedence, and wearing of barbes at funerals, over the chin and under the same.

MARGARET, the daughter of Woldemar III. king of Denmark, styled the *Semiramis of the North*: she succeeded her father in the throne of Denmark, her husband in that of Norway, and the crown of Sweden was given her as a recompence for delivering the Swedes from the tyranny of Albert their king. Thus
possessed

Margarita possessed of the three kingdoms, she formed the grand political design of a perpetual union, which she accomplished, *pro tempore* only, by the famous treaty styled the union of Calmar. She died in 1412, aged 59.

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Margariti-
tini.

MARGARET of Anjou, daughter of René D'Anjou, king of Naples, and wife of Henry VI. king of England; an ambitious, enterprising, courageous woman. Intrepid in the field, she signalled herself by heading her troops in several battles against the house of York; and if she had not been the authoress of her husband's misfortunes, by putting to death the duke of Gloucester his uncle, her name would have been immortalized for the fortitude, activity, and policy with which she supported the rights of her husband and son, till the fatal defeat at Tewksbury; which put an end to all her enterprises, the king being taken prisoner, and prince Edward their only son basely murdered by Richard duke of York. Margaret was ransomed by her father, and died in Anjou in 1482. See ENGLAND, p. 201—226.

MARGARET, (duchess of Newcastle.) See CAVENDISH.

MARGARITA, or PEARL-ISLAND, an island of South America, the middle of which is seated in W. Long. 64. 2. N. Lat. 11. 30. It was discovered by Columbus, and is about 35 leagues in compass. The soil is very fertile in maize and fruits, and abounds in pasture and verdant groves; yet is totally destitute of fresh water, which the inhabitants are obliged to bring from the continent. When the Spaniards first landed here, they found the natives busy in fishing for oysters. Columbus ordered some of the savages aboard his ship, who were so far from being terrified, that they very soon became familiar with the Spaniards. The latter at first imagined that the oysters served them for food; but on opening the shells, they found they contained valuable pearls. Upon this discovery they immediately landed, and found the natives ready to part with their pearls for the merest trifles. In process of time the Spaniards built a castle, called *Monpader*, and employed prodigious numbers of Guinea and Angola negroes in the pearl-fishery; cruelly forcing them to tear up the oysters from the rocks to which they stuck, during which time many of them were destroyed by the sharks and other voracious fishes. In 1620, this island was invaded by the Dutch, who demolished the castle upon it: since which time it has been in a manner abandoned by the Spaniards; and is now principally inhabited by the natives, to whom some particular indulgences were granted by the court of Spain, on account of their ready submission to Columbus.

MARGARITA, the PEARL, in natural history. See PEARL, and MYA.

MARGARITINI, are glass ornaments, made at Venice of small glass tubes of different colours, which are blown at Murano, and which the women of the lower class wear about their arms and necks. The largest sort are used for making rosaries. This work is performed with great dispatch, the artisan taking a whole handful of those tubes at once, and breaking them off one after another with an iron tool. These short cylinders are mixed with a kind of ashes, and put over the fire in an iron pan; and when the two ends begin to melt, by stirring them about with an iron

wire, they are brought to a round figure; but care is taken not to leave them too long over the fire, lest the hole through which they are to be strung should be entirely closed by the melting of the glass. There are several streets at Francesco de Vigna entirely inhabited by people whose sole occupation is to make and string these margaritini.

Margate,
Marhattas,

MARGATE, a sea-port town of Kent, on the north side of the life of Thanet, near the North-Foreland. It is noted for shipping vast quantities of corn (most, if not all, the product of that island) for London; and has a salt-water bath at the post-house, which has performed great cures in nervous and paralytic cases, and numbness of the limbs. It lies in St John's parish, which is a member of the port of Dover, at the distance of 14 miles, and 12 from Canterbury, and 72 from London; and in the summer season is frequented for sea-bathing, having become one of the principal watering-places for the idle, the opulent, and the invalid, where they meet with every requisite accommodation; and the adjacent country abounds with most extensive prospects and pleasant rides. E. Long. 1. 30. N. Lat. 51. 24.

MARHATTAS, **MERHATTAHS**, **MARATTAS**, or **MAHRATTAS**; a people of India, and by far the most considerable of all the Hindoo powers. The Marhattas boast a very high antiquity; they profess the religion of Brama; speak a dialect of the Sanscrit language, in which they have introduced all the technical terms of Moghul administration; use a character of their own in writing, though not very different from some of the other tribes around them; and are divided into four casts or classes of people, with the various subdivisions of professional distinction found over the rest of Hindostan, but with this remarkable difference, that among the Marhattas every individual may, as in fact he occasionally does, follow the life of a soldier.

As a nation inhabiting immemorially the country properly denominated *Marbat* or *Merbat*, and comprehending the greater part of the *Paithwa's* present dominion in the Decan, they were completely subjugated, and afterwards for many centuries depressed, first by the Patans, then by the Moghul conquerors of Delhi. At length, towards the end of Alemgere's reign, they united, rebelled, and under the famous *Seva-jeer* or *Seva-jeer*, a leader of their own tribe, laid the foundations of their present vast empire, which has risen gradually on the ruins of the Mahomedan power, as related under the article **HINDOSTAN**, p. 531, par. 6.

Seva-jeer was succeeded by his son *Rajah Sahou*, who considerably extended the Marhatta dominions. When *Rajah Sahou* grew old and infirm, and the fatigues of government began to press heavy upon him, he appointed *Biffonai Balajee*, a Brahman born at *Gokum*, and leader of about 25,000 horse, to the office of *Paithwa* or vicegerent.

Rajah Sahou died without issue, but left nephews by his brother. The courage and wisdom of *Balajee* had gained him, during the latter years of the old *Rajah*, the affection and esteem of all the nation. But, under an appearance of modesty and self-denial, his prevailing passion was ambition; and the sentiments

Notes relating to the
Hindous,
vol. ii.
p. 280, &c.

Marhattas, of gratitude and loyalty were absorbed in the desire to command. He made use of the influence he had acquired under his benefactor so firmly to establish his own power, that he not only retained the high office of Paishwa during his life, but transmitted it to his posterity. The Marhattas, gradually forgetting a prince they knew nothing of, became accustomed to obey his vicegerent only; yet a certain respect for the royal race, or the dread of the consequence of violating the strong prejudice which the nation still retains in favour of the family of its founder, have served perhaps to preserve it; and the descendants of Rajah Sahou's nephews yet exist, but are kept in captivity in the palace at Sattarah. The eldest is styled Ram Rajah, or sovereign; his name is on the seal and coin of the Marhatta state; but his person is unknown, except to those who immediately surround him. He resides in his splendid prison, encompassed with the appendages of eastern grandeur, but debarred of all power, and kept totally ignorant of business. The seat of government was transferred from the ancient royal residence of Sattarah to Poonah; and the usurper, as well as his successors, seem still to have acted under the supposed authority of the deposed prince, by their assuming no other title or character than that of Paishwa or prime-minister. From this change, the empire of the Ram-Rajah has been distinguished only by the appellation of the *Paishwasthip*, or otherwise the *Government of Poonah*, from the name of its present capital.

Biffonot Balajee was succeeded as Paishwa by his eldest son Balajee Row (called also *Nana Sahib*, or *Nanah Row*), who left three sons, the eldest of whom, Balajee Pundit, sometimes called Nanah Pundit, succeeded him. The two others were Rogobah or Ragonat Row, and Shamheer Row.

Balajee Pundit left two sons; Mahadava Row, who was Paishwa twelve years; and Narrain Row, who succeeded him.

During the latter part of the life of Mahadava Row, his uncle Rogobah was confined to the palace at Poonah, for reasons with which we are not acquainted. Mahadava Row died without issue; and upon the accession of Narrain his brother, a youth of about 19 years of age, Rogobah in vain applied to be released from his confinement. He is therefore suspected of having entered into a conspiracy with two officers in his nephew's service, Somair Jing and Yusuf Gardie, in order to procure that by force which he could not obtain by intreaty. The correspondence between the conspirators was carried on with so much secrecy, that the court had not the least intimation or suspicion of their design, till every avenue leading to the palace had been secured, and the whole building surrounded by the troops under the command of those two officers. It is said, that on the first alarm, Narrain Row, suspecting his uncle, ran to his apartment, threw himself at his feet, and implored his protection: "You are my uncle (said he), spare the blood of your own family, and take possession of a government which I am willing to resign to you."

Somair and Yusuf entered the room whilst the young Paishwa was in this suppliant posture. Rogobah, with apparent surprise and anger, ordered them

to withdraw; but as they either knew him not to be sincere, or thought they had proceeded too far to retreat, they stabbed Narrain with their poignards whilst he clung to his uncle's knees.

The office of Paishwa being now vacant, the chiefs of the nation then at Poonah were assembled, and Rogobah being the only survivor of the family of Biffonot Balajee, to whose memory the Marhattas in those parts are enthusiastically attached, he was named to fill it. Being naturally of a warlike temper, he resolved to undertake some foreign expedition; for besides gratifying his passion for the field, he probably hoped, by the splendour of his exploits, to draw off the attention of the public from inquiring into the late catastrophe.

A pretence for war was not difficult to be found. He renewed the claim of his nation to the *clout*, and marched his army towards Hydrabad, the capital of the Nizam. The vigour of his measures procured him an accommodation of his demand; and he was proceeding to enforce a similar one upon the Carnatic, when he received intelligence which obliged him to return hastily to Poonah.

Although the Marhatta chiefs had acknowledged Rogobah as Paishwa, yet they and the people in general were much dissatisfied with his conduct. The murderers of Narrain Row had not only escaped punishment, but, as was reported, had been rewarded. The crime was unexampled, and the perpetrators were beheld with uncommon horror and detestation. The Paishwa had hitherto so fully possessed the love of the people, that, till then, guards were considered as unnecessary about the person of a man whose character rendered him inviolable. Every one therefore had free access to his palace, and he relied with confidence for his safety upon the affections of those who approached him.

These reflections operated powerfully upon the minds of the Marhattas; but perhaps no violent consequences would have ensued, had it not been discovered, soon after the departure of Rogobah from Poonah, that the widow of Narrain Row, Ganga Baee, was pregnant. This determined their wavering resolutions. Frequent consultations were held among the principal men then in the capital; and it was finally resolved to abjure the allegiance they had sworn to Rogobah, and declare the child, yet unborn, to be the legal successor of the late Paishwa.

A council of regency was immediately appointed to govern the country until the child should become of age; and it was agreed to reserve their deliberations, in case it should prove a female or die, till the event should render them necessary. The youth principally conducted these measures, and whose names will on that account be remembered, were Sackkaram Babou and Balajee Pundit, called also Nanah Pher Nevees from his having been long the principal secretary of the Marhatta state. Nine other Marhatta leaders approved of these measures, and swore to maintain them.

As the first step towards the execution of their plan, the widow of Narrain Row was conveyed to Poorender, a fort of great strength, situated on a high mountain, about 25 miles from Poonah. As soon as Rogobah received intimation of this revolution, he march-

Marhatta. ed back towards the capital. But discontent had already infected his troops; of some of the chiefs retired to their estates, and others joined the standard of the regents. He however risked a battle with an army of the revolvers commanded by Trimbec Row, in which the latter was slain; but though he obtained a victory, the strength of the confederates daily increased, while his own troops were diminished by continual defections. He therefore found it necessary to retire to Ugein, and to solicit the assistance of the Marhatta chiefs Sindia and Holkar; but meeting with a refusal, he went to Surat, and applied for succour to the English.

Rogobah's success in this application was the cause of two wars with the Marhatta state; which, after much waste of blood and treasure, we were obliged to conclude by relinquishing his claim, and acknowledging as legal Paitiwa the son of Narraim Row, who was born about seven months after the death of his father. See INDIA, n° 121 and 152; also HINDOSTAN, n° 21.

The Marhatta dominions, as already observed, are governed by a number of separate chiefs, all of whom acknowledge the Ram Rajah as their sovereign; and all, except Moodajee Boonfalah, own the Paitiwa as his viceregent. The country immediately subject to the Paitiwa, including all the hereditary territories that were left by the Rajah Sahou to the Ram Rajah, and those that have been acquired and added to them since in his name, extends along the coast nearly from Goa to Cambay; on the south it borders on the possessions of Tippoo Saib, eastward on those of the Nizam and of the Marhatta Rajah of Berar, and towards the north on those of the Marhatta chiefs Sindia and Holkar.

Moodajee Boonfalah, Rajah of Berar, possesses, besides Berar, the greatest part of Orisa (see HINDOSTAN, p. 532, par. 6.). This prince being descended from the line of the Ram Rajah, eyes the power of the Paitiwa, by whom a branch of his family is kept in ignominious confinement, with ill-will; has often refused to support his measures; and, on some occasions, has even seemed inclined to act against him.

Next to Moodajee, in point of importance, must be ranked Madajee Sindia, a bold and aspiring chief, who possesses the greatest part of the extensive foubardry or government of Malva, together with part of the province, of Candeeih. The remainder is under the dominion of Holkar. Both he and Sindia pretend to be defended from the ancient kings of Malva. Sindia resides chiefly at Ugein, near the city of Mundu, once the capital of these kings; and Holkar at Indoore, a town little more than 30 miles west of it. The dominions of these, and of some chiefs of less consequence, extend as far as the river Jumna.

The measures pursued by the Marhattas for some years left little room to doubt that they aspired at the sovereignty of all Hindostan, or at least at the expulsion of the Mahomedan princes: And in this last design they appear to have succeeded; and to have gained a great accession of territory, through the arms of Sindia, both by the capture of the cities of Agra and Delhi, with their territorial dependencies, and the consequent captivity of the unfortunate monarch who ruled

there as the last imperial representative of the great Moghul race of Timur. "The whole of the dominion thus newly established is of vast extent, stretching near 1200 miles along the frontiers of Tippoo and the Nizam in a north-east direction, from Goa on the Malabar coast to Balafore in Orissa adjoining to Bengal; and from thence north-westerly 1000 miles more, touching the confines of the British and allied states, on the borders of the Ganges and Jumna, to the territory of the Sicks at Paniput, rendered famous in 1761 for the last memorable defeat sustained by the Marhattas in their ambitious contest for empire with the united declining power of the Mahomedans. From this place, in a southerly course, with great encroachment on the old eastern boundary of the Rajepoot country of Ajmere, it runs about 260 miles to the little Hindoo principality of Kotta, and thence south-westerly 540 miles further to the extreme point of the foubah of Gujrat at Duarka, including the whole of that fertile province; from whence, along the sea-coasts of Cambay and Malabar to Goa, the distance may be reckoned 800 miles. Thus the overgrown empire of the Marhattas may be said to extend east 19 degrees of longitude, near the parallel of 22 degrees north latitude, from the mouths of the Indus to those of the Ganges, and about 13 degrees of latitude north, from the Kistnah to Paniput; comprehending at least an area of 400,000 square geographic miles, being considerably more than a third part of Hindostan, including the Deccan, and equal perhaps in dimensions to all the British and allied states in India, with those of Golconda and Mysore, taken together."

MARIA, or **SANCTA MARIA**, an island of the Indian Ocean, lying about five miles east from Madagascar. It is about 27 miles long and five broad; well watered, and surrounded by rocks. The air is extremely moist, for it rains almost every day. It is inhabited by 500 or 600 negroes, but seldom visited by ships.

MARIA (St), a considerable town of South America, in the audience of Panama, built by the Spaniards after they had discovered the gold mines near it, and soon after taken by the English. It is seated at the bottom of the Gulf of St Michael, at the mouth of a river of the same name; which is navigable, and the largest that falls into the gulf. The Spaniards come here every year in the dry season, which continues three months, to gather the gold-dust out of the sands of the neighbouring streams; and carry away great quantities. W. Long. 148. 30. N. Lat. 7. 0.

MARIA (St), a handsome and considerable town of Spain, in Andalusia, with a small castle. It was taken by the English and Dutch in 1702; for the archduke of Austria. It is seated on the Guadaleta, at the mouth of which is a tower and a clove battery. W. Long. 5. 33. N. Lat. 36. 35.

MARIAN ISLANDS. See *LADRON ISLANDS*.

MARIANA (John), a learned Spanish historian, born at Talavera in the diocese of Toledo. He entered among the Jesuits in 1754, at 17 years of age; and became one of the most learned men of his time. He was a great divine, a good humanist, and profoundly versed in ecclesiastical as well as profane history. He taught

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taught at Rome, in Sicily, at Paris, and in Spain; and died at Toledo in 1624. His principal works are, 1. An excellent history of Spain in 30 books; which he himself translated from the Latin into Spanish, without servilely following his own Latin edition. 2. *Scholæ*, or short notes on the Bible. 3. A treatise on the changes the species has undergone in Spain; for which he was thrown into prison by the duke of Lerma, the Spanish minister. 4. A famous treatise *De rege et regis institutione*, which made much noise, and was condemned by the parliament of Paris to be burnt by the hands of the common hangman, for his asserting in that work, that it is lawful to murder tyrants. 5. A work on the faults of the government of the society of Jesuits, which has been translated into Spanish, Latin, Italian, French, &c.

MARIANUS SCOTUS, an Irish monk, was related to the Venerable Bede, and wrote a chronicle which is esteemed. He died in the abbey of Fuld in 1036, aged 68.

MARIBONE, or ST MARY LE BONE, or rather *Borne*, from the neighbouring brook, a parish of Middlesex, on the north-west side of London. The manor appears to have belonged anciently to the bishop of London. The houses in this parish are very numerous, comprising several extensive streets and squares, which are every year increasing. The Paddington road from Islington passes through this parish, which gives it communication with the eastern part of London without passing thro' the streets. Here were three conduits erected about the year 1238, for supplying the city of London with water; but anno 1703, when it was plentifully served by the New-River, the citizens let them out at 700l. a-year for 43 years. There were two for receiving its water at the north-east corner of the bridge on the river Tyburn, and over them flood the lord-mayor's banqueting-house, to which (the use of coaches being not then known) his lordship and the aldermen used to ride on horseback, as their ladies did in waggons. This banqueting-house, after being many years neglected, was taken down in 1737, and the cisterns areled over. This village, if it may be called by that name, is joined by new buildings to London. The old church, which was a mean edifice, was pulled down, and a new one erected in 1741. Besides which it has a great number of chapels of every sect and persuasion, and an extensive work-house for the poor.

MARIDUNUM (anc. geog.), a town of the Demetæ in Britain. Now *Caer Mardin*, or *Caermarthen*, the capital of Caermarthenshire.

MARIGALANTE, an island of North America, and one of the least of the Caribbees, lies in N. Lat. 16. 32. and W. Long. 61. 5. from London, at the distance of four leagues from Guadalupe, to the south. The soil, produce, and climate, are pretty much the same as the other Caribbees. Columbus discovered it on his second American voyage in 1483, and called it by the name of his ship *Maria Galanta*, or *Gallant Mary*. It is about six leagues long, and between three and four broad. Viewed at a distance from on board a ship, it appears like a floating island, because, as it is for the most part flat, the trees seem to swim; but a nearer prospect shows it to be intersected by some rising grounds, which give a fine variety to the landscape. The French settled here in 1648; and it

was taken by the English in 1691, but the French soon got possession of it again. It was again taken by the British in 1759, but afterwards restored at the peace 1763.—This island was thought, on its first discovery, to want water; but a charming running stream has in time been discovered, no less convenient than refreshing and wholesome, on the banks of which are some wealthy planters, and excellent plantations of sugar. A little village in a small bay is the capital of the island, and here the commandant resides. The whole island is very capable of improvement; the soil being almost equally good, and the land rising no where too high. The coast affords many little bays, and safe anchorage and shelter to ships.

MARINE, a general name for the navy of a kingdom or state; as also the whole economy of naval affairs; or whatever respects the building, rigging, arming, equipping, navigating, and fighting ships. It comprehends also the government of naval armaments, and the state of all the persons employed therein, whether civil or military.

The history of the marine affairs of any one state is a very comprehensive subject, much more of that of all nations. Those who would be informed of the maritime affairs of Great Britain, and the figure it has made at sea in all ages, may find abundance of curious matter in Selden's *Mare Clausum*; and from his time to ours, we may trace a series of facts in Lediard's and Burchet's Naval History, but above all in the Lives of the Admirals, by the accurate and judicious Dr Campbell.

MARINES, or *MARINE Forces*, a body of soldiers raised for the sea-service, and trained to fight either in a naval engagement or in an action ashore.

The great service of this useful corps was manifested frequently in the course of the war before last, particularly at the siege of Belleisle, where they acquired a great character, although lately raised and hardly exercised in military discipline. At sea they are incorporated with the ship's crew, of which they make a part; and many of them learn in a short time to be excellent seamen, to which their officers are ordered by the admiralty to encourage them, although no sea-officer is to order them to go aloft against their inclination. In a sea-fight their small-arms are of very great advantage in scouring the decks of the enemy; and when they have been long enough at sea to stand firm when the ship rocks, they must be infinitely preferable to seamen if the enemy attempts to board, by raising a battalion with their fixed bayonets to oppose him.

The sole direction of the corps of marines is vested in the lords commissioners of the admiralty; and in the admiralty is a distinct apartment for this purpose. The secretary to the admiralty is likewise secretary to the marines, for which he has a salary of L. 300 a-year; and he has under him several clerks for the management of this department.

The marine forces of Great Britain in the time of peace are stationed in three divisions; one of which is quartered at Chatham, one at Portsmouth, and another at Plymouth. By a late regulation, they are ordered to do duty at the several dock-yards of those ports, to prevent embezzlement of the king's stores, for which a captain's guard mounts every day; which certainly requires great vigilance, as so many abuses of this kind have

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have been committed, that many of the inhabitants, who have been long used to an infamous traffic of this kind, expect these conveyances at certain periods as their due, and of course resent this regulation in the highest degree as an infringement of their liberties as British subjects.

The marine corps are under the command of their own field-officers, who discipline them, and regulate their different duties.—His late majesty in 1760 formed a new establishment of marine officers, intitled, the *general, lieutenant-general, and three colonels* of marines (one for each division), to be taken from officers in the royal navy. The two first are always enjoyed by flag-officers, the last by post-captains only. This establishment was formed to reward such officers who distinguished themselves in the service of their country.

MARINE-Discipline, is the training up soldiers for sea-service, in such exercises as the various positions of the firelock and body, and teaching them every manœuvre that can be performed on board ships of war at sea. See EXERCISE.

MARINE-Chair, a machine invented by Mr Irwin for viewing the satellites of Jupiter at sea, and of course determining the longitude by their eclipses. An account of it is given in the *Journal Estranger* for March 1760. An account of its accuracy was published the year following by M. de L'Isle astronomer in the imperial academy of Peterburg: but notwithstanding the encomiums bestowed upon it by this gentleman, it hath never come into general use; and therefore we may conclude, that it is much inferior to the inventions of Mr Harrison for the same purpose. See HARRISON and LONGITUDE.

MARINE-Surveyor, is the name of a machine contrived by Mr H. de Saumarez for measuring the way of a ship in the sea. This machine is in the form of the letter Y, and is made of iron or any other metal. At each end of the lines which constitute the angle or upper part of that letter, are two pallets, not much unlike the figure of the log; one of which falls in the same proportion as the other rises. The falling or pendant pallet meeting a resistance from the water, as the ship moves, has by that means a circular motion under water, which is faster or slower according as the vessel moves. This motion is communicated to a dial within the ship, by means of a rope fastened to the tail of the Y, and carried to the dial. The motion being thus communicated to the dial, which has a bell in it, it strikes exactly the number of geometrical paces, miles, or leagues, which the ship has run. Thus the ship's distance is attained; and the forces of tides and currents may also be discovered by this instrument: which, however, has been very little used.

MARINE-Acid, a name given to one of the component parts of sea-salt. An account of various methods of procuring this acid from common salt, of most of its chemical properties, and of several uses it may be put to in the arts, is given under the articles CHEMISTRY, COLOUR-Making, BLEACHING, &c. M. Chaptal observes, that the marine acid cannot be obtained by distilling salt with powdered flints. He made the experiment by mixing ten pounds of flints with two pounds of sea-salt, but obtained only a mass of the colour of litharge, and the fumes were not perceptibly acid. Clay will decompose this salt for once, but not

in the smallest degree if used a second time; which shows that in all probability the decomposition is owing to a portion of vitriolic acid contained in the clay. In France there is a very impure kind of soda named *Blanquette*, which, according to M. Chaptal's analysis, contains 21 pounds of sea-salt out of 25; and yet, when treated with vitriolic acid, affords little or no spirit of salt, but abundance of volatile spirit of sulphur. Our author ascribes this to the quantity of charcoal contained in the *blanquette*, which unites with the vitriolic acid and volatilizes it: and his conjectures appeared to be right; because, if the coal is destroyed by calcination, the *blanquette* yields marine acid in proportion to the quantity of common salt it contains.

Under the article BLEACHING we have taken notice of the properties of the deploglitticated acid of sea-salt in whitening cloth: but though this has been often attempted, it does not appear likely to come into practice; nor does even the offer of a premium seem to encourage the bleachers of this country to make any serious endeavour to introduce it. This we can only account for in two ways: 1. From the very noxious and suffocating smell attending the operation, by which the health, and even the life of those who prepare this acid in an unskilful manner, as well as of the bleachers who make use of it, are greatly endangered. 2. From the excessive waste of vapour in the ordinary mode of preparation, which renders the liquid too dear for ordinary use.

To avoid these inconveniences, it has been recommended by chemists to force the vapour violently into larger quantities of water, and by compressing the fumes to a great degree, to render the liquid extremely strong, and then dilute it when it is to be used. By this means, however, the vapour forces out at the joinings of the distilling vessel in such a manner that no lute can keep it in; at the same time that the liquor being impregnated with an over-proportion of gas, lets go the superfluous quantity as soon as the pressure is taken off, thereby losing its power, and annoying with its noxious and indeed poisonous smell every one who comes near it. The trouble attending this preparation may be easily judged from the following description of the process given by M. Chaptal.

“To extract this acid (says he), I place a large glass alembic, of one single piece, upon a sand-bath. To the alembic I adopt a small receiver; and to the receiver three or four small bottles nearly filled with distilled water, and arranged according to the method of Mr Woulfe. I dispose the receiver and bottles in a cistern, the places of junction being luted with fat lute, and secured with rags soaked in the lute of lime and whites of eggs. Lastly, I surround the bottles with pounded ice. When the apparatus is thus disposed, I introduce into the alembic half a pound of manganese of Cevennes, and pour upon it, at several repetitions, three pounds of fuming muriatic acid. The quantity of acid which I pour at once is three ounces; and at each time of pouring, a considerable effervescence is raised. I do not pour a new quantity until nothing more comes over into the receivers. This method of proceeding is indispensably necessary when the operator is desirous of making his process with a definite quantity of materials: for if too large a quantity

Marine-
acid.

Marine
acid.

tity of acid be poured on at once, it is impossible to restrain the vapours; and the effervescence will throw a quantity of manganese into the receiver. The vapours which are developed by the effluvia of muriatic acid are of a greenish-yellow colour, and they communicate this colour to the water when they combine with it. When this vapour is concentrated by means of the ice, and the water is saturated with it, it forms a scum on the surface, which is precipitated through the liquid, and resembles a congealed oil. It is necessary to assist the action of the muriatic acid by means of a moderate heat applied to the sand-bath. The secure luting of the vessels is also an essential circumstance; for the vapour which might escape is suffocating, and would not suffer the chemist to inspect his operation closely. It is easy to discover the place where it escapes through the lutes by running a feather dipped in volatile alkali over them; the combination of these vapours instantly forms a white cloud, which renders the place visible where the vapour escapes.

"The same oxygenated muriatic acid may be obtained, by distilling in a similar apparatus ten pounds of marine salt, three or four pounds of manganese, and ten pounds of sulphuric (vitriolic) acid.

"Mr Rebol has observed, that the concrete state of this acid is a crystallization of it, which takes place at three degrees of temperature below the freezing point of Reaumur. The forms which have been observed are those of a quadrangular prism, truncated very obliquely, and terminated by a lozenge. He has likewise observed hollow hexahedral pyramids on the surface of the liquor.

"To make use of the oxygenated acid in the arts, and in order to concentrate a greater quantity in a given volume of water, the vapour is made to pass thro' a solution of alkaline salt. A white precipitate is at first formed in the liquid; but a short time afterwards the deposition diminishes, and bubbles are disengaged which are nothing but the carbonic acid. In this case two salts are formed, the oxygenated muriate and the ordinary muriate. The mere impression of light is sufficient to decompose the former, and to convert it into common salt. This lixivium contains indeed the oxygenated acid in a stronger proportion. The execrable smell of the acid is much weakened. It may be employed for various uses with the same success, and with great facility; but the effect is very far from corresponding with the quantity of oxygenated acid which enters into this combination, because the virtue of a great part is destroyed by its union with the alkaline basis.—The oxygenated muriatic acid has an excessively strong smell. It acts directly on the larynx, which it stimulates, excites coughing, and produces violent headaches."

The apparatus recommended by Mr Berthollet is on the same plan with M. Chaptal's, though the scale is much larger. Both are evidently troublesome; and cannot by any means be introduced into ordinary practice, where the preparation, as well as the method of using the liquor, must be left to workmen of little understanding and less attention. For these it is necessary to have an apparatus which may not readily be broken, which requires little trouble or dexterity in the using, and which may prepare great quantities at once. The principal difficulty is the condensation of the

Marine
acid.

fumes. To attempt violently to force steam of any kind into water is always improper, and seldom answers any purpose, unless when for chemical experiments the liquors are wanted of extraordinary strength. Water naturally attracts a certain proportion of every kind of vapour; and when once this natural attraction is satisfied, it is vain to attempt to force more into it. In proportion to the quantity of surface exposed to the steam, water will imbibe it in shorter or longer time; and therefore a broad shallow vessel is always preferable to a round or narrow deep one where distillations of this kind are to be performed.

It must also be observed, that the vapour with which the water is to be impregnated, ought not to rush out of the distilling vessel with too great haste; as in this case a great quantity will unavoidably be lost, by reason of the water not having time to absorb it all. To avoid this, matters should be managed in such a manner, that, without sensibly interrupting the operation, the vapour may issue from the distilling vessel gradually, and without sudden explosions; by which means the water will imbibe as fast as the vessel distills for a certain time; and in order to preserve all the vapour, there ought to be several receivers, one above the other, communicating by pipes, that the vapour which does not condense in one may do so in the other.—The following apparatus may be used with success:

1. For the distilling vessel. A large bottle of common brown earthen-ware, such as is represented on the margin, is undoubtedly the cheapest, and most eligible distilling-vessel that can be made use of; as it is not liable to break, and may be used for a long time without being corroded. It may be placed in a sand-bath; or in case it



is luted, it may be put on an open fire, which, however, ought not to be raised to any great height.

2. The receivers ought to be large square cisterns of wood, covered over on the inside with white wax, on which the acid has no effect; and they may be placed, for the greater convenience, one above the other, with cocks so situated, that the water of the upper cisterns may be discharged into the lower ones as occasion requires. The lowermost cistern must also be furnished with a cock, for running off the liquor into the vessels in which the cloth is to be steeped.

3. The bottle must be furnished with a glass tube to convey the steam from it into the receiver; but to prevent any of the acid from getting in amongst the liquor designed for bleaching, it will be necessary to have a small cork interposed betwixt it and the receivers; which will also prevent the liquor from being dirtied by any sudden swell of the mixture in the bottle.

4. It will be convenient, and which may be easily accomplished in most bleaching-houses, to have a small stream of clear water running into it, higher than the level of the uppermost reservoir by which means they can all be filled to a sufficient depth with very little trouble. The apparatus then will be as represented on Plate CCLXXX. where A is the bottle containing the mixture; B the sand pot, furnace, door, and ash-hole; C the glass tube to convey the steam into the

case D, placed there on purpose to catch any acid which may distil, or small quantity of the mixture which may boil over. E is another glass-tube communicating with the lowermost reservoir *d*, into which it conveys the steam to be absorbed by the water lying in its bottom. The three cisterns communicate on their upper parts by means of the pipes *m* and *n*, by which the steam which does not condense in the lower reservoir is conveyed to the middle one *e*, and that which does not condense in the middle one is conveyed to the upper one *f*; in which a vent is finally given to it at *g*; or if it is found that three reservoirs are not sufficient, there may be one or more placed on the top of these, in a manner similar to what we have already described.

The operation is to be begun by putting into the bottle A, a quantity of strong spirit of salt diluted with at least four times its quantity of water, sufficient to fill somewhat more than one half of it. The manganese, reduced to as fine a powder as possible, is to be made up into small pellets or balls, with water, and thrown in at the lateral neck of the bottle. A few only are to be thrown in at once, and the mouth instantly stopped with a cork; a brisk effervescence will immediately ensue, and a considerable quantity of vapours will come over without heat, passing thro' the pipes C and E into the reservoir *d*; from thence through *m* into the reservoir *e*, and from *e* into *f*; the small quantity which still remains undecomposed passing out at the vent *g*, which ought to be under a chimney, or to be fitted with an upright pipe going through the roof of the house.

A fire being applied, the vapour will begin to issue out through the pipes in greater quantities, but by the time the liquor has begun to boil, the dephlogisticated vapour will have entirely passed over. This may be easily known to be the case by the heat of the glass tubes. On this the cork is to be pulled out, and two or three more pellets of manganese are to be thrown in, and the mouth stopped up as quickly as possible. The vapour from these will be quickly dissipated, and the operation must be repeated until no more effervescence arises upon throwing in the manganese. When this is the case, a fresh quantity of spirit of salt diluted, but not so much as the preceding, is to be added, and this again treated with more manganese as before; continuing the operation till the bottle be supposed as full as is convenient for the operation. The whole must now be allowed to cool; and it would be proper to have another furnace, sand pot, and bottle, to join immediately to the reservoirs, that the operation may not be interrupted.—The water in the lowermost reservoir will always be most strongly impregnated, and may be known to be of sufficient strength when a few threads of flax put into it are visibly whitened in two or three minutes. It is then to be let off into the large reservoir for steeping the cloth; the water in the middle receiver, which is also partly impregnated with dephlogisticated gas, must be let down into the lowermost one by turning the cock of the pipe *i*, which runs off the water to the bottom. In like manner, the water in the upper cistern *f* is let down into the middle cistern *e*, by turning the cock belonging to the pipe *h*, while that in *f* is to be replaced by fresh water from the stream which runs into

the house.—The residuum of the distillation is a solution of manganese in common spirit of salt, from which the metal may be precipitated by caustic volatile alkali, and the liquid will afford sal ammoniac: the precipitate, by being calcined again till it grows black, may be used as fresh manganese; but considering the low price of this mineral, we can scarce recommend this process as worth the trouble. It is certain, however, that a great part of the marine-acid will remain undecomposed, even after we have added as much manganese as will excite any effervescence. This may be extemporaneously recovered by pouring into the distilling vessel a small quantity of oil of vitriol. This expels the marine acid from the manganese with which it is united, and renders it again capable of acting upon more; but when the addition of a small quantity of this acid has no effect in producing the proper gas, we may then be sure that the operation is totally finished. The residuum is now a combination of manganese with vitriolic acid, and may be decomposed by volatile alkali, so that it can still be of use to the makers of spirit of hart's-horn and sal ammoniac.

Thus we see, that by a very easy process, without the smallest danger to the health of the workman, an unlimited quantity of dephlogisticated spirit of salt may be prepared of a sufficient strength to answer every useful purpose; and it is evident from the foregoing description of the process, that the most is made of the materials, so that we can scarce expect a cheaper method. The practice of mixing together the salt, oil of vitriol, and manganese, all together in the distilling vessel, is by no means to be commended; for thus the matter always runs into an hard lump, which cannot be got out without breaking the vessel; and the vapour is, besides, forced out with such rapidity, that great part of it is unavoidably lost.

The next and most important consideration is the method of using the liquor after it is distilled. And here, as the volatility of the gas is the principal obstacle to the preservation of its strength, it is indispensibly necessary to have it to run from a covered spout into a covered vessel where the cloth is placed. It is likewise a matter of importance to have the cloth spread among the liquid in such a manner that the power of the gas may be equally diffused over its whole surface; for if it lies in folds upon one another, it will undoubtedly be spotted, let us do as we will. To prevent this in the most effectual manner, it is necessary to roll the cloth as is done by dyers to make their colours strike equally; for this operation we may account a kind of dyeing *white*; and the same precautions are undoubtedly necessary to make this colour equal as any other. It is probable, that vessels and rollers might be so constructed, that a number of pieces of cloth might be whitened all at once; and the operation of driving the rollers might be performed by a machine driven by water.

With regard to the use of this liquid itself, it must be observed, that though very cheap when made as above directed, yet water itself is still cheaper; and whatever can be done by mere water, ought to be previously done to the cloth before it is immersed in the dephlogisticated liquor. With this view it ought to undergo a long continued but gentle falling, a stream

of warm water constantly running upon it all the while. Thus an incredible quantity of filth will be separated; and it will be matter of surprise to those who have not made the experiment, to be told, that they could not, in 24 hours, wash a piece of cloth as it comes from the weaver so clean in repeated quantities of water but that it would still render the last quantity dirty. Cloth, when treated in this manner for a considerable time, will be very nearly as well whitened as that which has been boiled in alkali. Boiling in water has not an effect nearly equal to that of gentle beating while the cloth is immersed in water, neither are violent strokes so useful as those which are gentle; and it might undoubtedly be worth while to contrive a machine for the purpose of giving this gentle fulling, which, without injuring the texture of the cloth, might be continued for a long time, and would be advantageous either on the old or new plan of bleaching.

If this method of fulling should not be adopted, that of *streaming* the cloth, or immersing it for some time in a stream of running water, would be of very considerable use as a preparation: but boiling with alkaline salt seems more advantageously to be omitted till after the cloth has undergone two or three operations in the dephlogisticated liquor; because this liquid, even when very weak, will cleanse considerably, and extract a great quantity of fordes, which would load the alkali and destroy its force.

Having prepared the cloth in some of the methods above mentioned, it is to be put into the vessel designed for whitening, put over the roller, and a quantity of the liquid let into it. As the cloth whitens, the liquor gradually loses its smell, and soon becomes incapable of giving any additional whiteness. This may be perceived by having a small door in the side of the vessel, which may be opened occasionally, and a bit of the cloth pulled out through it and looked at. When the first quantity of liquid, therefore, appears to have no more effect, it must be allowed to run off into another vessel; but is not yet to be thrown away, because it is still much more powerful than water, and will have a considerable effect upon cloths which have undergone the aqueous preparation.

After the first quantity of liquid is run off, another must be admitted from the lowermost reservoir, and is to be used in the same manner with the former; only it will now be somewhat longer before its strength is exhausted. When this is the case, a third quantity is to be employed, and so on till we find that the effect of the liquid is beginning to diminish. The cloth must then be taken out, fullied, and thoroughly cleaned of the acid by water, before the next operation, which is boiling with alkali. The *lixivium* ought to be of considerable strength, that the liquor may easily be evaporated, and part of the alkali recovered by a process related under the article *POTASHES*; but as the cloth will necessarily retain a considerable quantity of this strong *lixivium*, it must be wrung out by a proper instrument for that purpose, and the liquid which falls from it saved and returned again into the kettle. The cloth, still retaining a quantity of alkali which could not be wrung out, must be thrown into a cauldron of boiling water, and allowed to remain there for a quarter of an hour; after which it is to be taken out and wrung as before. The water of the second

cauldron will be slightly alkaline, and may be used as a preparation for cloth, or for filling up the vessel containing the strong alkali as it evaporates.

Before the cloth is returned into the dephlogisticated liquor, it is absolutely necessary that the alkaline salt be entirely taken out of it, which can only be speedily done by fulling, streaming, or at least steeping in repeated quantities of water. When all this is done, it will most probably be of a darker colour than before; but this will go off in a few minutes, and the cloth will become much whiter than ever. The remainder of the operation is only a repetition of the processes already described, and for which no other directions are requisite than that both alkali and acid, the latter especially, always loosen a quantity of fordes, which, unless washed off, soon prevents their own operation. As soon, therefore, as the cloth is taken out of either the alkaline or acid liquor, there is a necessity for using every method consistent with the safety of its texture to clear it of this loose matter, which will allow the liquor into which it is next plunged to have the greater effect. It must be remembered, however, that the nearer the cloth approaches to perfect whiteness, the less effect has either of the liquids upon it; and therefore there is a necessity either for increasing the strength of the dephlogisticated acid, or allowing it a longer time; but the latter is by much the preferable method: and, after all, it would be far from being improper to expose the cloth for a few days to the air, which will effectually prevent any change of colour afterwards, as frequently happens to cloths bleached after this manner.

Could a ready method be fallen upon to bleach flax by itself, it would be greatly in favour of the linen manufacture; as the strength of the threads are vastly increased by this method. The great difficulty in this operation; arises from the filamentous nature of the flax; by which, when put into any liquid, it becomes matted together in such a manner as not to be separated afterwards by any means whatever so as to be spun with the same ease as before. The fairer and better dressed the lint is, the greater is this difficulty; and to obviate it, there seems to be no other possible method but that of using flax just as it comes from the mill, without any other dressing. Thus, indeed, the tow must be bleached as well as the flax; but when we consider, that thus it may be spun into much finer and stronger yarn than otherwise could be done, we cannot suppose this to be any disadvantage.

Another obstacle is the difficulty the liquid has in getting into the heart of the flax; so that the outside will be well whitened, when the inside is scarce altered. For this no other remedy seems adequate, besides the dividing it into many small parcels, tying them together in pairs, putting them over rods as candle-makers do their candles, and thus suspending them for a time in the liquid. They must be dipped in an hot solution of alkali in the same manner, afterwards for a considerable time in fresh water, to take out all the alkali; after which, they are to be again put into the acid liquor, and treated exactly as directed for the cloth. Thus, in two or three days, the flax will attain a surpassing whiteness. It is then to be dressed and treated exactly as other flax, but must be dried without any kind of wringing or pres-

Mariner,
St Marino

Marino
||
Maritagium

sure.—This method would appear to be useful, even though the utmost degree of whiteness should not be given, as the texture of the threads will be much less injured by the subsequent bleaching than if the flax had been spun in its natural state.

Mr Chaptal observes, that this acid may be applied to the whitening of paper and old prints; and by its means (he says) they obtain a whiteness which they never had before. Common ink disappears by its action, but it has no effect upon printer's ink.—It thickens oils, and calcines metals to such a degree, that the process may be much expedited by its means. It dissolves metals without effervescence, and precipitates mercury from its solutions, converting it into corrosive sublimate.—It acts, likewise, very vigorously upon metallic calces, forming with them salts more readily than other acids.

M. Chaptal observes, that the combination of the marine acid with vegetable alkali, named *sibirigine salt of Sylvius*, is found, though in small quantities, in seawater, plaster, and the ashes of tobacco. "The existence of this salt (says he) in the ashes of tobacco, might with justice have surprised me, as I had reason to expect the muriate of soda, which is employed in the operation called *watering*. Was the soda metamorphosed into pot-ash by the vegetable fermentation? This may be determined by direct experiments."

MARINER, the same with a sailor or seamen. See these articles.

Method of preserving the health of MARINERS. See SEAMEN.

MARINER'S Compass. See COMPASS.

St MARINO, a small town and republic of Italy, situated in E. Long. 13. 44. N. Lat. 44. 21. This small republic consists only of a mountain, and a few hillocks, that lie scattered about the bottom of it. The number of the inhabitants is about 5000. The mountain yields good wine, but they have no other than rain or snow water. The founder of the republic was a Dalmatian, and a mason, who upwards of 1300 years ago turned hermit, and retired to this mountain. Here his devotion and austerity, and, in consequence of that, his reputation for sanctity, were such, that the princes of the country made him a present of the mountain; on which many, out of veneration for the saint, soon after took up their abode. Thus was the foundation laid of the town and republic, which still bears the name of the saint. The town stands on the top of the mountain, and there is only one way by which it can be come at. In the whole territory are only three castles, three convents, and five churches. The largest of the churches is dedicated to the saint, and contains his ashes and his statue. He is looked upon as the greatest saint, next to the blessed Virgin; and to speak disrespectfully of him is accounted blasphemy, and punished as such. The republic is under the protection of the pope. All that are capable of bearing arms are exercised, and ready at a minute's call. In the ordinary course of government, the administration is in the hands of the council of 60, which, notwithstanding its name, consists only of 40; one half of the members of which are of the noble families, and the other of the plebeian; on extraordinary occasions, however, the *arango*, in which every house has its representative, is

called together. The two principal officers are the capitaneos, who are chosen every half year; and next to them is the commissary, who judges in civil and criminal matters, and is joined in commission with the capitaneos; both he and the physician must be foreigners, and both have their salaries out of the public stock. When any person, after due summons, neglects to assist at the council according to their statute-book, he is to be fined in about a penny English; and when an ambassador is to be sent to any foreign state, he is to be allowed about 18 s. a-day.

MARINO (John Baptist), a celebrated Italian poet, born at Naples in 1569. His father, who was an able civilian, obliged him to study the law; at which being disgusted, he left his parents, and retired to the house of the Sieur Manzi, who was a friend to all persons of wit. He at length became secretary to Matthew of Capua, great admiral of the kingdom of Naples, and contracted a friendship with Tasso. A short time after, he went to Rome, and entered into the service of cardinal Aldobrandini, nephew to pope Clement VIII. who took him with him to Savoy. Marino was in great favour with the court of Turin; but afterwards created himself many enemies there, the most furious of whom was the poet Gaspard Murtola, who, attempting to shoot him with a pistol, wounded one of the duke of Savoy's favourites. Marino being obliged to leave Turin, went to Paris at the desire of queen Mary de Medicis, and published there his poem on Adonis. He afterwards went to Rome, where he was made prince of the academy of the humorists; from thence to Naples, where he died while he was preparing to return home. He had a very lively imagination, but little judgment; and, giving way to the points and conceits then in vogue, his authority, far from correcting the false taste of the Italians, served rather to keep it farther from reformation. His works, which are numerous, have been often printed.

MARINUS, an engraver who flourished about the year 1630, and resided principally at Antwerp. His plates, Mr Strutt observes, are executed in a very singular style, with the graver only: The strokes are very fine and delicate, and crossed over each other in a lozenge-like form, which he filled up with thin, long dots. His prints, though generally very neat, want the style of the master in the determination of the folds of the draperies and the outline of the human figure; the extremities of which are heavy, and not marked with precision. Fine impressions from his best plates are, however, much sought after by collectors; those especially after Rubens and Joardens are held in very high estimation.

MARIONIS, (anc. geog.) a town of Germany: now Hamburg, a famous trading city on the Elbe, in Lower Saxony, in the duchy of Holstein. Another Marionis (Ptolemy), thought to be Wismar, a town of Lower Saxony, in the duchy of Mecklenburg.

MARIOTTE (Edme), an eminent physician and mathematician, was born in Burgundy, and was made a member of the academy of sciences. He died in 1684. His works, which are much esteemed, were printed at Leyden in 1717, 2 vols 4to.

MARJORAM, in botany. See ORIGANUM.

MARITAGIUM, in the feudal customs, *maritagium* (as contradicting with *matrimonium*), signifies

Maritime
Maritime
State.

sies the power which the lord or guardian in chivalry had of disposing of his infant ward in matrimony. For while the infant was in ward, the guardian had the power of tendering him or her a suitable match without disparagement or inequality: which if the infants refused, they forfeited the value of the marriage, *valorem maritagii*, to their guardian; that is, so much as a jury would assess, or any one would *bona fide* give to the guardian for such an alliance: and if the infants married themselves without the guardian's consent, they forfeited double the value, *duplicem valorem maritagii*.

MARITIME, something relating to, or bounded by, the sea. Thus a maritime province or country is one bounded by the sea; and a maritime kingdom is one that makes a considerable figure, or that is very powerful at sea. Hence, by *maritime* powers among the European states, are understood great Britain and Holland.

MARITIME State, in British polity, one of the three general divisions of the laity: (See LAITY). This state is nearly connected with the military; though much more agreeable to the principles of our free constitution. The royal navy of England hath ever been its greatest defence and ornament; it is its ancient and natural strength; the floating bulwark of the island; an army from which, however strong and powerful, no danger can ever be apprehended to liberty: and accordingly it has been assiduously cultivated from earliest ages. To so much perfection was our naval reputation arrived in the 12th century, that the code of maritime laws, which are called the *laws of Oleron*, and are received by all nations in Europe as the ground and substraction of all their marine constitutions, was confessedly compiled by our king Richard I. at the isle of Oleron on the coast of France, then part of the possessions of the crown of England. And yet so vastly inferior were our ancestors in this point to the present age, that even in the maritime reign of queen Elizabeth, Sir Edward Coke thinks it matter of boast, that the royal navy of England then consisted of *three and thirty ships*. The present condition of our marine is in great measure owing to the salutary provisions of the statutes called the *navigation acts*; whereby the constant increase of English shipping and seamen was not only encouraged, but rendered unavoidably necessary. By the statute 5 Richard II. c. 3. in order to augment the navy of England, then greatly diminished, it was ordained, that none of the king's liege people should ship any merchandize out of or into the realm, but only in ships of the king's ligenance, on pain of forfeiture. In the next year, by statute 6 Ric. II. c. 8. this wise provision was enervated, by only obliging the merchants to give English ships (if able and sufficient) the preference. But the most beneficial statute for the trade and commerce of these kingdoms is that navigation-act, the rudiments of which were first framed in 1650, with a narrow partial view; being intended to mortify our own sugar islands, which were disaffected to the parliament, and held out for Charles II. by stopping the gainful trade which they then carried on with the Dutch, and at the same time to clip the wings of those our opulent and aspiring neighbours.

Maritime
State.

This prohibited all ships of foreign nations from trading with any English plantations, without licence from the council of state. In 1651, the prohibition was extended also to the mother-country: and no goods were suffered to be imported into England, or any of its dependencies, in any other than English bottoms; or in the ships of that European nation of which the merchandize imported was the genuine growth or manufacture. At the Restoration, the former provisions were continued, by stat. 12 Car. II. c. 18. with this very material improvement, that the master and three-fourths of the mariners shall also be English subjects.

Many laws have been made for the supply of the royal navy with seamen; for their regulation when on board; and to confer privileges and rewards on them during and after their service.

1. For their supply. The principal, but the most odious, though often necessary method for this purpose, is by impressing; see IMPRESSING. But there are other ways that tend to the increase of seamen, and manning the royal navy. Parishes may bind out poor boys apprentices to the masters of merchantmen, who shall be protected from impressing for the first three years; and if they are impressed afterwards, the masters shall be allowed their wages: great advantages in point of wages are given to volunteer seamen, in order to induce them to enter into his majesty's service: and every foreign seaman, who, during a war, shall serve two years in any man of war, merchantman, or privateer, is naturalized *ipso facto*. About the middle of king William's reign, a scheme was set on foot for a regifter of seamen to the number of 30,000, for a constant and regular supply of the king's fleet; with great privileges to the registered men; and, on the other hand, heavy penalties in case of their non-appearance when called for: but this registry, being judged to be rather a badge of slavery, was abolished by stat. 9 Ann. c. 21.

2. The method of ordering seamen in the royal fleet, and keeping up a regular discipline there, is directed by certain express rules, articles, and orders, first enacted by the authority of parliament soon after the Restoration; but since new-modelled and altered, after the peace of Aix-la-Chapelle, to remedy some defects which were of fatal consequence in conducting the preceding war. In these articles of the navy almost every possible offence is set down, and the punishment thereof annexed: in which respect the seamen have much the advantage over their brethren in the land-service; whose articles of war are not enacted by parliament, but framed from time to time at the pleasure of the crown. Yet from whence this distinction arose, and why the executive power, which is limited so properly with regard to the navy, should be so extensive with regard to the army, it is hard to assign a reason; unless it proceeded from the perpetual establishment of the navy, which rendered a permanent law for their regulation expedient, and the temporary duration of the army, which subsisted only from year to year, and might therefore with less danger be subjected to discretionary government. But, whatever was apprehended at the first formation of the mutiny-act, the regular renewal of our standing force at the entrance

Marius. entrance of every year has made this distinction idle. For, if from experience past, we may judge of future events, the army is now lastingly ingrafted into the British constitution; with this singularly fortunate circumstance, that any branch of the legislature may annually put an end to its legal existence, by refusing to concur in its continuance.

3. With regard to the privileges conferred on soldiers, they are pretty much the same with those conferred on soldiers, with regard to relief, when maimed, or wounded, or superannuated, either by county-rates, or the royal hospital at Greenwich; with regard also to the exercise of trades, and the power of making nuncupative testaments: and, farther, no seaman aboard his majesty's ships can be arrested for any debt, unless the same be sworn to amount to at least twenty pounds; though, by the annual mutiny-acts, a soldier may be arrested for a debt which extends to half that value, but not to a less amount.

MARIUS, the famous Roman general, and seven times consul, who sullied his great military reputation by savage barbarities. He was born at Arpinum, of obscure and illiterate parents. He forsook the meaner occupations of the country for the camp; and signalized himself under Scipio, at the siege of Numantia. The Roman general saw the courage and intrepidity of young Marius, and foretold the era of his future greatness. By his seditions and intrigues at Rome, while he exercised the inferior offices of the state, he rendered himself known; and his marriage with Julia, who was of the family of the Cæsars, contributed in some manner to raise him to consequence. He passed into Africa as lieutenant to the consul Metellus against Jugurtha; and after he had there ingratiated himself with the soldiers, and raised enemies to his friend and benefactor, he returned to Rome and canvassed for the consulship. The extravagant promises he made to the people, and his malevolent insinuations about the conduct of Metellus, proved successful. He was elected and appointed to finish the war against Jugurtha. He showed himself capable in every degree to succeed to Metellus. Jugurtha was defeated, and afterwards betrayed into the hands of the Romans by the perfidy of Boecchus. No sooner was Jugurtha conquered, than new honours and fresh trophies awaited Marius. The provinces of Rome were suddenly invaded by an army of 300,000 barbarians, and Marius was the only man whose activity and boldness could resist so powerful an enemy. He was elected consul, and sent against the Teutones. The war was prolonged, and Marius was a third and fourth time invested with the consulship. At last two engagements were fought, and not less than 200,000 of the barbarian forces of the Ambrones and Teutones were slain in the field of battle, and 90,000 made prisoners. The following year, A. U. C. 651, was also marked by a total overthrow of the Cimbri, another horde of barbarians; in which 140,000 were slaughtered by the Romans, and 60,000 taken prisoners. After such honourable victories, Marius with his colleague Catullus entered Rome in triumph; and for his eminent services he received the appellation of the *third founder of Rome*. He was elected consul a sixth time; and as his intrepidity had delivered his country from its foreign ene-

mies, he sought employment at home, and his restless ambition began to raise seditions, and to oppose the power of Sylla. This was the foundation of a civil war. Sylla refused to deliver up the command of his forces, with which he was empowered to prosecute the Mithridatic war; and he resolved to oppose in person the authors of a demand which he considered as arbitrary and improper. He advanced to Rome, and Marius was obliged to save his life by flight. The unfavourable winds prevented him from seeking a safer retreat in Africa, and he was left on the coast of Campania, where the emissaries of his enemy soon discovered him in a marsh, where he had plunged himself in the mud, and left only his mouth above the surface for respiration. He was violently dragged to the neighbouring town of Minturnæ; and the magistrates, all devoted to the interest of Sylla, passed sentence of immediate death on their magnanimous prisoner. A Gaul was commanded to cut off his head in the dungeon; but the stern countenance of Marius disarmed the courage of the executioner: and when he heard the exclamation of *Tune, homo, audes occidere Caium Marium*, the dagger dropped from his hand. Such an uncommon adventure moved the compassion of the inhabitants of Minturnæ. They released Marius from prison; and favoured his escape to Africa, where he joined his son Marius, who had been arming the princes of that country in his cause. Marius landed near the walls of Carthage, and he received no small consolation at the sight of the venerable ruins of a once powerful city, which like himself had been exposed to calamity, and felt the cruel vicissitude of fortune. This place of his retreat was soon known; and the governor of Africa, to conciliate the favour of Sylla, compelled Marius to fly to a neighbouring island. He soon after learned that Cinna had embraced his cause at Rome, when the Roman senate had stripped him of his consular dignity, and bestowed it upon one of his enemies. This intelligence animated Marius; he set sail to assist his friend only at the head of 1000 men. His army, however, was soon increased, and he entered Rome like a conqueror. His enemies were inhumanly sacrificed to his fury; Rome was filled with blood; and he, who once had been called the father of his country, marched through the streets of the city, attended by a number of assassins, who immediately slaughtered all those whose salutations were not answered by their leader. Such were the signals for bloodshed. When Marius and Cinna had sufficiently gratified their resentment, they made themselves consuls; but Marius, already worn out with old age and infirmities, died sixteen days after he had been honoured with the consular dignity for the seventh time, A. U. C. 666. Such was the end of Marius, who rendered himself conspicuous by his victories and by his cruelty. As he was brought up in poverty and among peasants, it will not appear wonderful that he always betrayed rusticity in his behaviour, and despised in others those polished manners and that studied address which education had denied him. He hated the conversation of the learned only because he was illiterate; and if he appeared an example of sobriety and temperance, he owed these advantages to the years of obscurity which he passed at Arpinum. His coun-

Marius.

Mark.
Mark.

nance was stern, his voice firm and imperious, and his disposition untractable. He was in the 70th year of his age when he died; and Rome seemed to rejoice at the fall of a man whose ambition had proved so fatal to many of her citizens. His only qualifications were those of a great general; and with these he rendered himself the most illustrious and powerful of the Romans, because he was the only one whose ferocity seemed capable to oppose the barbarians of the north.

C. MARIUS, the son of the great Marius, was as cruel as his father, and shared his good and his adverse fortune. He made himself consul in the 25th year of his age, and murdered all the senators who opposed his ambitious views. He was defeated by Sylla, and fled to Præneste, where he killed himself.

MARIUS, (M. Aurelius), a native of Gaul; who, from the mean employment of a blacksmith, became one of the generals of Gallienus, and at last caused himself to be saluted emperor. Three days after this elevation, a man who had shared his poverty without partaking of his more prosperous fortune, publicly assassinated him, and he was killed by a sword which he himself had made in the time of his obscurity. Marius has been often celebrated for his great strength; and it is confidently reported, that he could stop, with one of his fingers only, the wheel of a chariot in its most rapid course.

MARIUS (Maximus), a Latin writer, who published an account of the Roman emperors from Trajan to Alexander, now lost. His compositions were entertaining, and executed with great exactness and fidelity. Some have accused him of inattention, and complain that his writings abounded with many fabulous and insignificant stories.

MARIVAUX (Peter Carlet de), a French writer in the dramatic way and in romance, was born of a good family at Paris in 1688. A fine understanding, well improved by education, distinguished him early. His first object was the theatre, where he met with the highest success in comic productions; and these, with the merit of his other works, procured him a place in the French academy. The great characteristic of both his comedies and romance was, to convey an useful moral under the veil of wit and sentiment: "My only object (says he) is to make men more just and more humane;" and he was as amiable in his life and conversation as he was in his writings. He died at Paris in 1763, aged 75. His works consist of, 1. *Pieces de Theatre*, 4 vols 12mo. 2. *Homere travesti*, 12mo; which is not supposed to have done much honour to his taste. 3. *Le Spectateur François*, 2 vols 12mo. 4. *Le Philosophe Indigent*, 12mo. 5. *Vie de Marianne*, 2 vols 12mo; one of the best romances in the French language. 6. *Le Payfan Parvenu*, 12mo. 7. *Pharlamon*; inferior to the former.

MARK (St.) was by birth a Jew, and descended of the tribe of Levi. He was converted by some of the apostles, probably by St. Peter; to whom he was a constant companion in all his travels, supplying the place of an amanuensis and interpreter. He was by St. Peter sent into Egypt, fixing his chief residence at Alexandria, and the places thereabout: where he was so successful in his ministry, that he converted multitudes both of men and women. He afterwards reme-

ved westward, towards the parts of Libya, going through the countries of Marmorea, Pentapolis, and others thereabouts; where, notwithstanding the barbarity and idolatry of the inhabitants, he planted the gospel. Upon his return to Alexandria, he ordered the affairs of that church, and there suffered martyrdom in the following manner. About Easter, at the time the solemnities of Serapis were celebrated, the idolatrous people, being excited to vindicate the honour of their deity, broke in upon St. Mark, while he was performing divine service, and, binding him with cords, dragged him through the streets, and thrust him into prison, where in the night he had the comfort of a divine vision. Next day the enraged multitude used him in the same manner, till his spirits failing, he expired under their hands. Some add, that they burnt his body, and that the Christians decently interred his bones and ashes near the place where he used to preach. This happened in the year of Christ 68. Some writers assert, that the remains of St. Mark were afterwards, with great pomp, translated from Alexandria to Venice. However, he is the tutelar saint and patron of that republic, and has a very rich and stately church erected to his memory. This apostle is author of one of the four gospels inscribed with his name. See the following article.

St MARK'S Gospel, a canonical book of the New Testament, being one of the four gospels.

St Mark wrote his gospel at Rome, where he accompanied St. Peter in the year of Christ 44. Tertullian and others pretend, that St Mark was no more than an amanuensis to St. Peter, who dictated this gospel to him; others affirm, that he wrote it after St. Peter's death. Nor are the learned less divided as to the language it was written in; some affirming that it was composed in Greek, others in Latin. Several of the ancient heretics received only the gospel of St. Mark: others, among the Catholics, rejected the 12 last verses of this gospel. The gospel of St. Mark is properly an abridgement of that of St. Matthew.

St MARK the Evangelist's Day, a festival of the Christian church, observed April 25.

Canons of St MARK, a congregation of regular canons founded at Mantua, by Albert Spinola a priest, towards the end of the 12th century. Spinola made a rule for them, which was approved, corrected, and confirmed by several succeeding popes. About the year 1450 they were reformed, and followed only the rule of St. Augustine. This congregation having flourished by the space of 400 years, declined by little and little, and is now become extinct.

Knights of St MARK, an order of knighthood in the republic of Venice, under the protection of St. Mark the evangelist. The arms of the order are, gules, a lion winged or; with this device, PAX TIBI MARCE EVANGELISTA. This order is never conferred but on those who have done signal service to the commonwealth.

MARK, or *Mare*, in commerce, denotes a weight used in several states of Europe, and for several commodities, especially gold and silver. In France, the mark is divided into eight ounces, 64 drachms, 192 deniers or penny-weights, 160 esterlins, 300 mailles, 610 felins, or 4608 grains. In Holland, the mark weight is 32

Mark.

so called *Troy weight*, and is equal to that of France. When gold and silver are sold by the mark, it is divided into 25 carats.

MARK is also used among us for a money of account, and in some other countries for a coin. See *MONEY-Talk*.

The English mark is two thirds of a pound Sterling, or 13 s. 4 d. and the Scotch mark is of equal value in Scots money of account, viz. 13½ d.

MARKET, a public place in a city or town, in which live-cattle, provisions, or other goods, are set to sale; and also a privilege, either by grant or prescription, by which a town is enabled to keep a market.

Court of the Clerk of the MARKET, is incident to every fair and market in the kingdom, to punish misdemeanors therein; and a court of *pie poudre* is to determine all disputes relating to private or civil property. The object of this jurisdiction (see stat. 17. Car. II. cap. 19. 22 Car. II. cap. 8. 23 Car. II. cap. 12.) is principally the cognizance of weights and measures, to try whether they be according to the true standard thereof or no: which standard was anciently committed to the custody of the bishop, who appointed some clerk under him to inspect the abuse of them more narrowly; and hence this officer, though now usually a layman, is called the clerk of the market.—If they be not according to the standard, then, beside the punishment of the party by fine, the weights and measures themselves ought to be burnt. This is the lowest court of criminal jurisdiction in the kingdom.

MARKHAM (Gervase), an English author, was the son of Robert Markham of Gotham, Esq; in Nottinghamshire, and bore a captain's commission under Charles I. in the civil wars. He was esteemed both a good soldier and a good scholar. He was particularly master of the French, Italian, and Spanish. He wrote, 1. The tragedy of Herod and Antipater, which was printed in 1622. 2. Many volumes upon husbandry and horsemanship. 3. A piece on the art of fowling. 4. The soldiers accidence and grammar.

MARKLAND (Jeremiah), one of the most learned scholars and penetrating critics of the age, was born in 1692, and received his education in Christ's Hospital. He became first publicly known by his *Epistola Critica*, addressed to bishop Hare. In this he gave many proofs of extensive erudition and critical sagacity. He afterwards published an edition of Statius, and some plays of Euripides; and assisted Dr Taylor in his editions of Lyfias and Demosthenes, by the notes which he communicated to him. He has also very happily elucidated some passages in the New Testament, which may be found in Mr Bowyer's edition of it; and was author of a very valuable volume of remarks on the epistles of Cicero to Brutus, and of an excellent little treatise under the title of *Quæstio Grammatica*. He died in 1775, at Milton, near Dorking in Surry; and was a man not more valued for his universal reading than beloved for the excellency of his heart and primitive simplicity of manners.

MARLBOROUGH, a town of Wiltshire in England, situated near the source of the Kennet, at the foot of a chalky hill, 75 miles from London. It has

its name from its chalky foil, which was formerly called *marle*. It was a Roman station. In the year 1627, a parliament was held in the castle here, which made those laws called *Marlborough statutes*. There are still some small remains of its walls and ditch. The town, which is an ancient borough by prescription, sends two members to parliament. It is governed by a mayor, 2 justices, 12 aldermen, 24 burgesses, a town-clerk, 2 bailiffs, 12 serjeants at mace, &c. It consists chiefly of one broad street, with piazzas all along one side of it, two parish churches, and several commodious inns, it being the grand thoroughfare from London to Bath and Bristol. To the south are some remains of a priory, particularly the Gate-house; and the site of a Roman Castrum, the foundations of which have been discovered there, with Roman coins. The ditch is still in some parts 20 feet wide; and towards the river, without the garden walls, one angle of the Castrum is very visible with the rampart and ditch entire. The mound at the west end of the town, which was the keep or main-guard of the castle, is converted into a pretty spiral walk; at the top of which is an octagon summer-house. This town has often suffered by fire, particularly in 1690, whereupon the parliament passed an act to prevent its houses from being thatched. The markets here are Wednesdays and Saturdays; and it has five fairs. Here is a charity-school, which was erected in 1712, for 44 children.

MARLBOROUGH (duke of). See CHURCHILL.

MARLBOROUGH-Fort, an English factory on the west coast of the island of Sumatra in Asia; seated three miles west of the town of Bencoolen. E. Long. 101. 12. S. Lat. 4. 21.

MARLE, a kind of calcareous earth, very much used in agriculture as a manure. See AGRICULTURE, n° 216, 217.

Marle is dug in many places of Great Britain and Ireland. In digging for it in Ireland, they meet with horns and other curious fossils. The marle always lies in the bottoms of low bogs, and is found by boring with augres made for that purpose. It usually lies at five, seven, or nine feet depth. The obtaining it in many places is attended with very considerable expence in draining off the water. The manner of digging it is this: They employ six able labourers and a supernumerary; and these cut up a hole of 12 feet square, which is supposed a pit that this number of men can manage in one day. Two men dig, two throw it up, and two throw it by, and the supernumerary man supplies defects on all occasions. For the first three feet they dig through a fuzzy earth, fit for making turf or fuel. Under this lies a stratum of gravel, of about half a foot; under this often, for three feet more, there is a more kindly moss, which would make better fuel. This lower stratum is always full of fossil wood, which is usually so soft that the spade cuts as easily through it as through the earth it lies in. Under this, for the thickness of about three inches, is found a series of leaves, principally of the oak. These appear very fair to the eye, but fall to pieces on being touched; and this stratum is sometimes interrupted by vast heaps of seed, which seem to be broom or furze seed. In some places there appear berries of different kinds, and in others several species

Marle

of sea-plants; all lying in the same confused manner as the oak leaves. Under this vegetable stratum there lies one of blue clay, half a foot thick, and usually full of sea-shells. This blue clay is not so tough as common clay; but is thrown carefully up, and used as marle in some places. Under this always appears the true marle; the stratum of which is usually from two to four feet thick, and sometimes much more.—This marle looks like buried lime, and is full of shells, which are usually of a small size, and of the periwinkle kind; but there are several other sorts at times found among them. Among this marle, and often at the very bottom of it, are found great numbers of very large horns of the deer kind, which are vulgarly called *elk's horns*. These, where they join to the head, are thick and round; and at that joining there grows out a branch, which is about a foot long, and seems to have hung just over the creature's eyes: it grows still round for about a foot above this; and then spreads out broad, and terminates in branches long and round, terminating with a small bend. The labourers are obliged to work in a hurry in all these pits, so that they seldom bring out the horns whole. There are also, at times, found the leg-bones and other parts of the skeletons of the same beasts; but this more rarely, only a few together, and but in few places.

Dr Black is of opinion, that all kinds of marle derive their origin from the calcareous matter of shells and lithophyta.

Shell-marle, says he, is composed of the shells of aquatic animals, which are sometimes very entire, and often decayed or mixed down with other earthy substances. Examining this matter as occurring in different places, it may be distinguished into fresh water marle, and the marle of sea-shells. Of the first we have an example in the Meadow at Edinburgh. Wherever the soil is turned up to the depth of six inches, a quantity appears. It is composed of the shells of a small fresh-water snail or welk. This animal, when alive, is not easily discernible, the shell being much of the same obscure colour as the stones covered with the water. But we can observe a great number of them in all running brooks and other collections of fresh water; and as the animal dies, the shells are deposited where the water stagnates in very great quantity. That composed of sea-shells, constitutes greater collections that are found in innumerable places now far removed from the sea. That most particularly described by Reaumur is a collection of this kind in a province of France, and at Turin. That part of the country where it is found is computed to contain 80 square miles of surface; and wherever they dig to a certain depth, they find this collection of shells: the country at present is 108 miles from the sea. They find the marle eight or nine feet below the surface, and they dig it to the depth of 20 feet. It is still deeper, but they find it too expensive to search for it. He supposes it to be only 18 feet deep; and even at this depth the quantity will appear enormous. It will amount to 140 millions of cubic fathoms of shells that are mostly decayed and broken into fragments, and mixed with other marine productions, as millipores, madripores, and other coralline bodies, which are all productions of the sea.

Marline
||
Marmalade

MARLINE, in sea affairs, are tarred white stains, or long wreaths or lines of untwisted hemp, dipped in pitch or tar, with which cables or other ropes are wrapped round, to prevent their fretting or rubbing in the blocks or pulleys through which they pass. The same serves in artillery upon ropes used for rigging gins, usually put up in small parcels called *skains*.

MARLOE (Christopher), an English dramatic author, was a student in the university of Cambridge; but afterwards turning player, he trode the same stage with the inimitable Shakspeare. He was accounted an excellent poet even by Ben Johnson himself. He wrote six tragedies, one of which called *Luff's Dominion*, or the *Lascivious Queen*, has been altered by Mrs Behn, and acted under the title of *Abdelazar*, or the *Moor's Revenge*. Some time before his death, he had made a considerable progress in an excellent poem entitled *Hero and Leander*; which was afterwards finished by George Chapman, who is said to have fallen short of the spirit and invention discovered by Marloe. Mr Anthony Wood represents him as a free-thinker, in the worst sense of the word; and gives the following account of his death. Falling deeply in love with a low girl, and having for his rival a fellow in livery, Marloe, imagining that his mistress granted him favours, was fired with jealousy, and rushed upon him in order to stab him with his dagger; but the footman avoided the stroke, and, seizing his wrist, stabbed him with his own weapon; of which wound he died, in the year 1593.

MARLOW, a town of Buckinghamshire, in England, 31 miles from London, lies under the Chiltern Hills, in a marly soil. It is a pretty large borough, though not incorporated, with a bridge over the Thames, not far from its conflux with Wycomb, and has a handsome church and town-hall, with a charity-school for 20 boys, who are taught and clothed. It first sent members to Parliament in the reign of Edward II. Bone lace is its chief manufacture. The Thames brings goods hither from the neighbouring towns, especially great quantities of meal and malt from High-Wycomb, and beech from several parts of the county, which abounds with this wood more than any in England. In the neighbourhood are frequent horse-races; and here are several corn and paper mills, particularly on the river Loddon, between this town and High-Wycomb. There are, besides, the Temple-mills, for making thimbles, and another for pressing oil from rape and flax seeds. Its market is on Saturdays, and fair October 29.

MARLY, a palace belonging to the king of France, between Versailles and St Germain; seated in a valley, near a village and forest of the same name. It is noted for its fine gardens and water-works, there being a curious machine on the river Seine, which not only supplies them with water, but also those of Versailles. It is 10 miles N. W. of Paris. E. Long. 2. 11. N. Lat. 48. 52.

MARMANDE, a town of France, in Guienne, and in Agennois. It carries on a great trade in corn and wine, and is seated on the river Garonne, in E. Long. o. 15. N. Lat. 38. 35.

MARMALADE, a confection of plums, apricots, quinces, &c. boiled up to a consistence with sugar. In

Marmor || Scotland, it is made of Seville oranges and sugar only.

Maronites.

MARMOR. See **MARBLE.**

MARMORA, the name of four islands of Asia, in the sea of the same name. The largest is about 30 miles in circumference; and the soil of them all produces corn, wine, and fruits. The sea of Marmora is a large gulph, which communicates both with the Archipelago and the Black Sea by that of Constantinople, being 120 miles in length and 20 in breadth; and all ships must pass through it that sail to Constantinople from the Mediterranean. It was anciently the *Propontis*.

MARMORICA, a country of Africa anciently inhabited by the Libyans. It was bounded on the east by Egypt, on the west by Cyrenaica, on the south by Sahara, or the desert of Libya Interior, and on the north by the Mediterranean; and was reckoned a part of Egypt. There is no distinct history of the country.

MAROBUDUM (anc. geog.), the royal residence of Marobudus, king of the Marcomanni; and hence the appellation. Now thought to be *Prague*, the capital of Bohemia.

MAROLLES (Michel de), born in 1600, was the son of Claude de Marolles, whom French memoirs make a military hero. Michel, however, was of a different composition. He entered early into the ecclesiastical state, and by the interest of his father obtained two abbeys. He was formed with an extreme ardour for study, which never abated all his life long: for, from 1619 when he published a translation of Lucan, to 1681 the year of his death, he was constantly employed in writing and printing. He attached himself unfortunately to the translating of ancient Latin writers: but, being devoid of all classical taste and spirit, they sunk miserably under his hands, the poets especially. He was certainly, however, a man of great learning, and discovered all his life a love for the arts. He was one of the first who paid any attention to prints; and collected about 100,000, which make at this day one of the ornaments of the French king's cabinet. He composed memoirs of his own life, which were published by the Abbé Goujet, 1755, in 3 vols. They contain, like such sort of things, some interesting facts, but an infinity of minute and insipid notions.

MARONITES, in ecclesiastical history, a sect of eastern Christians, who follow the Syrian rite, and are subject to the pope; their principal habitation being on mount Libanus.

Mosheim informs us, that the doctrine of the Monothelites, condemned and exploded by the council of Constantinople, found a place of refuge among the Mardaites, a people who inhabited the mounts Libanus and Antilibanus, and who, about the conclusion of the seventh century, were called *Maronites*, after *Maro* their first bishop; a name which they still retain. None (he says) of the ancient writers give any certain account of the first person who instructed these mountaineers in the doctrine of the Monothelites: it is probable, however, from several circumstances, that it was John Maro, whose name they had adopted; and that this ecclesiastic received the name of Maro from his having lived in the character of a monk in the fa-

mous convent of St Maro, upon the borders of the Orontes, before his settlement among the Mardaites of mount Libanus. One thing is certain, from the testimony of Tyrius and other unexceptionable witnesses, as also from the most authentic records, viz. that the Maronites retained the opinions of the Monothelites until the 12th century, when, abandoning and renouncing the doctrine of one will in Christ, they were readmitted in the year 1182 to the communion of the Roman church. The most learned of the modern Maronites have left no method unemployed to defend their church against this accusation; they have laboured to prove, by a variety of testimonies, that their ancestors always persevered in the Catholic faith, in their attachment to the Roman pontiff, without ever adopting the doctrine of the Monophysites, or Monothelites. But all their efforts are insufficient to prove the truth of these assertions to such as have any acquaintance with the history of the church and the records of ancient times; for to all such the testimonies they allege will appear absolutely fictitious and destitute of authority.

Faultus Nairon, a Maronite settled at Rome, has published an apology for Maron and the rest of his nation. His tenet is, that they really took their name from the Maron, who lived about the year 400, and of whom mention is made in Chrysostom, Theodoret, and the Menologium of the Greeks. He adds, that the disciples of this Maron spread themselves throughout all Syria; that they built several monasteries, and, among others, one that bore the name of their leader; that all the Syrians who were not tainted with heresy took refuge among them; and that for this reason the heretics of those times called them Maronites.

Mosheim observes, that the subjection of the Maronites to the spiritual jurisdiction of the Roman pontiff was agreed to with this express condition, that neither the popes nor their emissaries should pretend to change or abolish any thing that related to the ancient rites, moral precepts, or religious opinions, of this people: so that in reality there is nothing to be found among the Maronites that favours of popery, if we except their attachment to the Roman pontiff, who is obliged to pay very dear for their friendship. For, as the Maronites live in the utmost districts of poverty, under the tyrannical yoke of the Mahometans, the bishop of Rome is under the necessity of furnishing them with such subsidies as may appease their oppressors, procure a subsistence for their bishop and clergy, provide all things requisite for the support of their churches, and the uninterrupted exercise of public worship, and contribute in general to lessen their misery. It is certain that there are Maronites in Syria who still behold the church of Rome with the greatest aversion and abhorrence; nay, what is still more remarkable, great numbers of that nation residing in Italy, even under the eye of the pontiff, opposed his authority during the last century, and threw the court of Rome into great perplexity. One body of these non-conforming Maronites retired into the valleys of Piedmont, where they joined the Waldenses; another, above 600 in number, with a bishop and several ecclesiastics at their head, fled into Corsica, and implored the protection of the republic of Genoa against the violence of the inquisitors.

Maroon

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Marpurg.

The Maronites have a patriarch, who resides in the monastery of Cannubin, on mount Libanus, and assumes the title of patriarch of Antioch, and the name of Peter, as if he seemed desirous of being considered as the successor of that apostle. He is elected by the clergy and the people, according to the ancient custom; but, since their reunion with the church of Rome, he is obliged to have a bull of confirmation from the pope. He keeps a perpetual celibacy, as well as the rest of the bishops his suffragans: as to the rest of the ecclesiastics, they are allowed to marry before ordination; and yet the monastic life is in great esteem among them. Their monks are of the order of St Antony, and live in the most obscure places in the mountains, far from the commerce of the world.

As to their faith, they agree in the main with the rest of the eastern church. Their priests do not say mass singly; but all say it together, standing round the altar. They communicate in unleavened bread; and the laity have hitherto partaken in both kinds, though the practice of communicating in one has of late been getting footing, having been introduced by little and little. In Lent they eat nothing, unless it be two or three hours before sun-rising: their other fastings are very numerous.

To MAROON, to put one or more sailors ashore upon a desolate island, under pretence of their having committed some great crime. This detestable expedient has been repeatedly practised by some inhuman commanders of merchant-ships, particularly in the West Indies.

MAROT (Clement), the best French poet of his time, was born at Cahors in 1495; and was the son of John Marot, valet de chambre to Francis I. and poet to queen Anne of Brittany. He enjoyed his father's place of valet de chambre to Francis I. and was page to Margaret of France wife to the duke of Alençon. In 1521 he followed that prince into Italy, and was wounded and taken prisoner at the battle of Pavia; but at his return to Paris was accused of heresy, and thrown into prison, from whence he was delivered by the protection of king Francis I. He at length retired to the queen of Navarre, then to the duchess of Ferrara, and in 1536 returned to Paris: but declaring openly for the Calvinists, he was obliged to fly to Geneva; which he at length left, and retiring to Piedmont, died at Turin in 1544, aged 50. His verses are agreeably filled with natural beauties. La Fontaine acknowledged himself his disciple, and contributed greatly to restore to vogue the works of this ancient poet. Marot, besides his other works, has translated part of the Psalms into verse, which was continued by Beza, and are still sung in the Protestant churches abroad.—*Michael Marot*, his son, was also the author of some verses; but they are not comparable to those of *John*, and much less to those of *Clement Marot*.—The works of the three *Marots* were collected and printed together at the Hague in 1731, in 3 vols 4to, and in 6 vols 12mo.

MARPURG, a strong and considerable town of Germany, in the Upper Rhine, and in the landgrate of Hesse-Cassel, with an university, a castle, a palace, a handsome square, and a magnificent town-house. It is seated on the river Lahn, in a pleasant

country, 15 miles south of Waldeck, and 47 south-west of Cassel. E. Long. 8. 53. N. Lat. 50. 42.

MARPURG, a handsome town of Germany, in Lower Styria, seated on the river Drave, 25 miles south-west of Gratz, and 60 north-east of Laubach. E. Long. 16. 10. N. Lat. 46. 42.

MARQUARD (Freher), an eminent German civilian, born at Augsburg in 1565. He studied at Bourges, under the learned Cujas; and acquired great skill in polite literature, and in the laws. At his return to Germany, he became counsellor to the elector Palatine, and professor of law at Heidelberg; and was afterwards sent by the elector Frederic IV. as his minister, into Poland, to Mentz, and several other courts: He died at Heidelberg in 1614. He wrote many works which are esteemed; the principal of which are, 1. *De re monetaria veterum Romanorum, et bodierni apud Germanos imperii.* 2. *Rerum Bolesemicarum scriptores.* 3. *Rerum Germanicarum scriptores.* 4. *Corpus historie Francia, &c.*

MARQUE, or Letters of MARQUE, in military affairs, are letters of reprisal, granting the subjects of one prince or state liberty to make reprisals on those of another.—They are so called from the German *marcke*, "limit, frontier;" as being *jus concessum in alterius principis marcas seu limites transgredi, sibi que jus faciendi*; as being a right of passing the limits or frontiers of another prince, and doing one's self justice.

Letters of marque among us are extraordinary commissions granted by authority for reparation to merchants taken and despoiled by strangers at sea; and reprisals is only the retaking, or taking of one thing for another*. The form in these cases is, the sufferer must first apply to the lord privy-seal, and he shall make out letters of request under the privy-seal; and if, after such request of satisfaction made, the party required do not, within convenient time, make due satisfaction or restitution to the party grieved, the lord chancellor shall make him out letters of marque under the great seal; and by virtue of these he may attack and seize the property of the aggressor nation, without hazard of being condemned as a robber or pirate.

MARQUESAS ISLANDS, the name of certain islands in the South Sea, lying between 8 and 10 degrees of south latitude, and between 129 and 140 degrees of west longitude. They are five in number, viz. La Magdalena, St Pedro, La Dominica, Santa Christina, and Hood Island. All the natives of these islands may be supposed to be of the same tribe. Those spots that are fit for culture are very populous; but as every island is very mountainous, and has many inaccessible and barren rocks, it is to be doubted whether the whole population of this group amounts to 50,000 persons. The Spaniards, who first visited here, found the manners of this people gentle and inoffensive; but these qualities did not prevent those who landed from wantonly butchering several of the natives at Magdalena.

The inhabitants of these islands collectively, says Captain Cook, are, without exception, the finest race of people in the South Sea. For symmetry of shape, and regular features, they perhaps surpass all other nations. Not a single deformed or ill-proportioned person was seen on the island; all were strong, tall, well-limbed, and remarkably active. The men are about

Marquard

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Marquesas.

See Pre-rogative.

Marquesas. five feet ten or six inches high; their teeth are not so good, nor are their eyes so full and lively, as those of many other nations: their hair is of many colours, but none red; some have it long, but the most general custom is to wear it short, except a bunch on each side the crown, which they tie in a knot: their countenances are pleasing, open, and full of vivacity: they are of a tawny complexion, which is rendered almost black by punctures over the whole body. They were entirely naked, except a small piece of cloth round their waist and loins. The punctures were disposed with the utmost regularity, so that the marks on each leg, arm, and cheek, were exactly similar. The women, in two days time, began to appear in considerable numbers, and the sailors found them not less kind than those of the other islands which they had visited: they were inferior to the men in stature, but well proportioned; their general colour was brown; no punctures were observed upon them; they wore a single piece of cloth made of the mulberry bark, which covered them from the shoulders to the knees.

The principal head-dress used in the islands, and what appear to be their chief ornament, is a sort of broad fillet, curiously made of the fibres of the hulks of cocoa-nuts; in the front is fixed a mother-of-pearl shell, wrought round to the size of a tea-saucer; before that another smaller, of very fine tortoise-shell, perforated into curious figures; also before, and in the centre of that, is another round piece of mother-of-pearl, about the size of half a crown; and before this another piece of perforated tortoise-shell, the size of a shilling. Besides this decoration in front, some have it also on each side, but in small pieces; and all have fixed to them the tail-feathers of cocks, or tropic-birds, which when the fillet is tied on stand upright, so that the whole together makes a very sprightly ornament. They wear round the neck a kind of ruff or necklace made of light wood, the outward and upper sides covered with small pease, which are fixed on with gum; they also wear some bunches of human hair fastened to a string, and tied round the legs and arms. But all the above ornaments are seldom seen on the same person. All these ornaments, except the last, they freely parted with for a trifling consideration; but the human hair they valued very highly, though these bunches were the usual residence of many vermin. It is probable, that these were worn in remembrance of their deceased relations, and therefore were looked upon with some veneration; or they may be the spoils of their enemies, worn as the honourable testimonies of victory. However, a large nail, or something which struck their eyes, commonly got the better of their scruples. The king, or chief of the island, came to visit Captain Cook; he was the only one seen completely dressed in this manner. Their ordinary ornaments are necklaces, and amulets made of shells, &c. All of them had their ears pierced, though none were seen with ear-rings. The king had not much respect paid him by his attendants: he presented Captain Cook with some fruit and hogs; and acquainted him that his name was *Honoo*, and that he was *be-ka-ai*, which title seems to correspond with the *aree* of Otaheitee, and *arekee* of the Friendly Isles. Their dwellings are in the valleys, and on the sides of the hills near their plantations. They are built in the same manner as those

at Otaheitee, which will be particularly described *Marquesas.* when we speak of that island; but they are much meaner, and are only covered with the leaves of the bread-fruit tree: in general, they are built on a square or oblong pavement of stone, raised some height above the level of the ground; they likewise have such pavement near their houses, on which they fit to eat and amuse themselves. Along the uppermost edge of the mountain a row of stakes or palisades, closely connected together, were seen like a fortification, in which, by the help of glasses, appeared something like huts, which seemed to bear a great resemblance to the hupas of New-Zealand, which will be described in speaking of that country. Their canoes resemble those of Otaheitee, but not so large; their heads had commonly some flat upright piece, on which the human face was coarsely carved; and their sails were made of mats, triangular in shape, and very broad at the top: the paddles which they used were of heavy hard wood; short, but sharp-pointed, and with a knob at the upper end; they were from 10 to 20 feet long, and about 15 inches broad.

Their weapons were all made of the club-wood, or casuarina; and were either plain spears about 8 or 10 feet long, or clubs which commonly had a knob at one end. They have also slings with which they throw stones with great velocity, and to a great distance, but not with a good aim.

The language of these people is much nearer to that of Otaheitee than any other dialect in the South-Sea, except that they could not pronounce the letter *r*.

The only quadrupeds seen here were hogs, except rats; here were fowls, and several small birds in the woods, whose notes were very melodious. The chief difference between the inhabitants of the Marquesas and those of the Society Islands seems to consist in their different degrees of cleanliness: the former do not bathe two or three times a-day, nor wash their hands and face before and after every meal, as the latter do; and they are besides very slovenly in the manner of preparing their meals. Their diet is chiefly vegetable; though they have hogs and fowls, and catch abundance of fish at certain times. Their drink is pure water, cocoa-nuts being scarce here.

It was not long before the propensity of the natives was discovered to be rather to receive than give; for when they had taken a nail as the price of a bread-fruit, the article so purchased could not be obtained from them. To remove this dishonest disposition, captain Cook ordered a musket to be fired over their heads, which terrified them into fair-dealing.

Soon after the natives had gathered courage enough to venture on board the ship, one of them unfortunately stole an iron stanchion from the gang-way, with which he sprang into the sea, and, notwithstanding its weight, swam with it to his canoe, and was making to the shore with all speed. A musket was fired over his head to frighten him back, but to no effect, he still continued to make off with his booty; the whistling of another ball over his head was as ineffectual: an officer, less patient of such an injury than reason and humanity should have taught him to be, levelled a musket at the poor fellow, and shot him thro' the head. Captain Cook had given orders to fire over the

Marquesas,
Marquetry.

the canoe, but not to kill any one; he was in a boat, and came up with the canoe soon after. There were two men in her: one fat bailing out the blood and water in a kind of hysterical laugh; the other, a youth of about 14 or 15 years of age, who afterwards proved to be the son of the deceased, fixed his eyes on the dead body with a serious and dejected countenance. This act of severity, however, did not estrange the islanders to the ship, and a traffic was carried on to the satisfaction of both parties; bread-fruit, bananas, plantains, and some hogs, were given in exchange for small nails, knives, and pieces of Amsterdam cloth; red feathers of the Amsterdam-Island were greatly esteemed here. Captain Cook, accompanied with the gentlemen of the ship, in their walks about the country, lighted on the house which had been the habitation of the man who had been shot; there they found his son, who fled at their approach: they enquired for his female relations, and were told that they remained at the top of the mountain, to weep and mourn for the dead. Notwithstanding they were then among the relations of a man who had been killed by them, not the least tokens of animosity or revenge were discernible among the natives.

The weather being extremely hot, the inhabitants made use of large fans to cool themselves, of which great numbers were purchased; these fans were formed of a kind of tough bark, or grass, very firmly and curiously plaited, and frequently whitened with shell-lime. Some had large feathered leaves of a kind of palm, which answered the purpose of an umbrella.

The natives at length became so familiar as to mount the sides of the ship in great numbers. They frequently danced upon deck for the diversion of the sailors: their dances very much resembled those of Otaheitee; their music too was very much the same.

A sailor having been inattentive to his duty, received several blows from Captain Cook; on seeing which, the natives exclaimed, *tape-a-hei-te tina*, "he beats his brother." From other instances that had occurred, it was clear that they knew the difference between the commander and his people, but at the same time they conceived them all brethren; and, says Mr Forster, "to me the most natural inference is, that they only applied an idea to us in this case, which really existed with regard to themselves; they probably look on themselves as one family, of which the eldest born is the chief or king."

MARQUETRY, IN-LAID WORK; a curious kind of work, composed of pieces of hard fine wood of different colours, fastened, in thin slices, on a ground, and sometimes enriched with other matters, as tortoise-shell, ivory, tin, and brass.

There is another kind of marquetry made, instead of wood, of glasses of various colours; and a third, where nothing but precious stones and the richest marbles are used: but these are more properly called *mosaic-work*. See MOSAIC.

The art of inlaying is very ancient; and is supposed to have passed from the east to the west, as one of the spoils brought by the Romans from Asia. Indeed it was then but a simple thing; nor did it arrive at any

tolerable perfection till the 15th century among the Marquetry. Italians: it seems, however, to have arrived at its height in the 17th century among the French.

Till John of Verona, a cotemporary with Raphael, the finest works of this kind were only black and white, which are what we now call *Morello's*; but that religious, who had a genius for painting, stained his woods with dyes or boiled oils, which penetrated them. But he went no farther than the representing buildings and perspectives, which require no great variety of colours. Those who succeeded him, not only improved on the invention of dyeing the woods, by a secret which they found of burning them without consuming, which served exceedingly well for the shadows; but had also the advantage of a number of fine new woods of naturally bright colours, by the discovery of America. With these assistances the art is now capable of imitating any thing; whence some call it the *art of painting in wood*.

The ground whereon the pieces are to be ranged and glued, is ordinarily of oak or fir well dried; and to prevent warping, is composed of several pieces glued together. The wood to be used, being reduced into leaves, of the thickness of a line, is either stained with some colour, or made black for shadow; which some effect by putting it in sand extremely heated over the fire, others by steeping it in lime-water and sublimate, and others in oil of sulphur.—Thus coloured, the contours of the piece are formed according to the parts of the design they are to represent.

The last is the most difficult part of marquetry, and that wherein most patience and attention are required. The two chief instruments used herein are the saw and the vice; the one, to hold the matters to be formed; the other, to take off from the extremes, according to occasion. The vice is of wood, having one of its chaps fixed; the other moveable, and is opened and shut by the foot, by means of a cord fastened to a treadle. Its structure is very ingenious, yet simple enough.

The leaves to be formed (for there are frequently three or four of the same kind formed together) are put within the chaps of the vice, after being glued on the outermost part of the design whose profile they are to follow; then the workman pressing the treadle, and thus holding fast the piece, with his saw runs over all the outlines of the design.—By thus joining and forming three or four pieces together, they not only gain time, but the matter is likewise the better enabled to sustain the efforts of the saw; which, how delicate soever it may be, and how lightly soever the workman may conduct it, without such a precaution would be apt to raise splinters, to the ruin of the beauty of the work.

When the work is to consist of one single kind of wood, or of tortoise-shell, on a copper or tin ground, or *vice versa*, they only form two leaves on one another, *i. e.* a leaf of metal, and a leaf of wood or shell: this they call *sawing in counter-parts*; for by filling the vacancies of one of the leaves by the pieces coming out of the other, the metal may serve as a ground to the wood, and the wood to the metal.

All the pieces thus formed with the saw, and marked to know them again, and the shadow given in the man-

Marquis *Marriage.* ner already mentioned; they vance or fasten each in its place on the common ground; using for that purpose the best English glue.

The whole is put in a press to dry, planed over, and polished with the skin of the sea-dog, wax, and shave-grass, as in simple veneering; with this difference, however, that in marquetry the fine branches, and several of the more delicate parts of the figures, are touched up and finished with a graver.

It is the cabinet-makers, joiners, and toy-men among us who work in marquetry; it is the enamellers and stone-cutters who deal in mosaic-work: the instruments used in the former are mostly the same with those used by the ebouistes.

MARQUIS, a title of honour, next in dignity to that of duke. His office is to guard the frontiers and limits of the kingdom, which were called the *marches*, from the Teutonic word *marche*, a "limit;" as, in particular, were the marches of Wales and Scotland, while they continued hostile to England. The persons who had command there, were called *lords marchers*, or *marquesses*; whose authority was abolished by statute 27 Hen. VIII. c. 27. though the title had long before been made a mere design of honour, Robert Vere earl of Oxford being created marquis of Dublin by Richard II. in the eighth year of his reign. A marquis is created by patent; his mantle is double ermine, three doublings and a half; his title is *most honourable*; and his coronet has pearls and strawberry-leaves intermixed round, of equal height.

MARR, that part of Aberdeenshire situated between the rivers Dee and Don.

MARRACCI (Lewis), a very learned Italian, was born at Lucca in Tuscany in 1612. After having finished his juvenile studies, he entered into the congregation of regular clerks of the mother of God, and distinguished himself early by his learning and merit. He taught rhetoric seven years, and passed thro' several offices of his order. He applied himself principally to the study of languages, and attained of himself the knowledge of the Greek, the Hebrew, the Syriac, the Chaldee, the Arabic; which last he taught some time at Rome, by the order of pope Alexander VII. Pope Innocent XI. chose him for his confessor, and placed great confidence in him. He would have advanced him to ecclesiastical dignities, if Marracci had not opposed him.—Marracci died at Rome in 1700, aged 87.—He was the author of several pieces in Italian; but the grand work, which has made him deservedly famous all over Europe, is his edition of the Alkoran, in the original Arabic, with a Latin version, notes, and confutation of his own. It was beautifully printed in 2 vols folio at Padua in 1698. The Latin version of the Alkoran, by Marracci, with notes and observations from him and others, and a synopsis of the Mahometan religion, by way of introduction, was published by Heineccius at Leipzig, 1721, in 8vo. Marracci had also a hand in the "Biblia sacra Arabica, sacrae congregationis de propaganda fide jussu edita, ad usum ecclesiarum orientalium," Rome 1671, in 3 vols folio.

MARRIAGE, a contract, both civil and religious, between a man and a woman, by which they engage to live together in mutual love and friendship for the ends of procreation, &c. See *MORAL Philosophy*.

Marriage. Marriage is part of the law of nations, and is in use among all people. The Romanists account it a sacrament.—The woman, with all her moveable goods, immediately upon marriage, passes wholly in *potestatem viri*, "into the power and disposal of the husband."

The first inhabitants of Greece lived together without marriage. Cecrops, king of Athens, is said to have been the first author of this honourable institution among that people. After the commonwealths of Greece were settled, marriage was very much encouraged by their laws, and the abetting from it was discountenanced and in many places punished. The Lacedemonians were very remarkable for their severity towards those who deferred marriage beyond a limited time, as well as to those who wholly abstained from it. The Athenians had an express law, that all commanders, orators, and persons intrusted with any public affair, should be married men. Polygamy was not commonly tolerated in Greece. The time of marriage was not the same in all places. The Spartans were not permitted to marry till they arrived at their full strength; the reason assigned for which custom by Lycurgus was, that the Spartan children might be strong and vigorous: and the Athenian laws are said to have once ordered, that men should not marry till 35 years of age. The season of the year which they preferred for this purpose was the winter, and particularly the month of January, called *Gamelion*. The Greeks thought it scandalous to contract marriage within certain degrees of consanguinity; whilst most of the barbarous nations allowed incestuous mixtures.

Most of the Grecian states, especially such as made any figure, required their citizens should match with none but citizens, and the children were not allowed to marry without the consent of their parents. The usual ceremonies in promising fidelity was kissing each other, or giving their right hands, which was a general form of ratifying all agreements. Before the marriage could be solemnized, the gods were to be consulted, and their assistance implored by prayers and sacrifices, which were offered to some of the deities that superintended these affairs, by the parents or nearest relations of the persons to be married. When the victim was opened, the gall was taken out and thrown behind the altar, as being the seat of anger and malice, and therefore the aversion of all the deities who had the care of love, as well as those who became their votaries. For the particularities relating to the bride and bridegroom, see *BRIDE* and *BRIDE-GROOM*.

The Romans, as well as the Greeks, disallowed of polygamy. A Roman might not marry any woman who was not a Roman. Among the Romans, the kalends, nones, and ides of every month were deemed unlucky for the celebration of marriage, as was also the feast of the *parentalia*, and the whole month of May. The most happy season in every respect was that which followed the ides of June.

The Roman laws speak of second marriages in very hard and odious terms: *Matre jam secundo nuptiis junctata*, L. iii. C. de sec. nuptiis. By these laws it was enacted, that the effects of the husband or wife deceased should pass over to the children, if the survivor should marry a second time. By the law *Hac*
edita

Marriage. *ed. Itali* (Cod. de fec. nupt.), the survivor, upon marrying a second time, could not give the person he married a portion more than equal to that of each of the children. In the primitive church the respect to chastity was carried so high, that a second marriage was accounted no other than a lawful whoredom, or a species of bigamy; and there are some ancient canons which forbid the ecclesiastics from being present at second marriages.

Marriage, by the Mosaic law, was subject to several restrictions: thus by Levit. chap. xviii. ver. 16. a man was forbid to marry his brother's widow unless he died without issue; in which case it became enjoined as a duty. So it was forbid to marry his wife's sister, while she was living, ver. 18.; which was not forbidden before the law, as appears from the instance of Jacob.

The ancient Roman law is silent on this head; and Papinian is the first who mentions it, on occasion of the marriage of Caracalla. The lawyers who came after him stretched the bonds of affinity so far, that they placed adoption on the same foot with nature.

Affinity, according to the modern canonists, renders marriage unlawful to the fourth generation, inclusive; but this is to be understood of direct affinity, and not of that which is secondary or collateral. *Affinis mei affinis, non est affinis meus.* It is farther to be observed, that this impediment of marriage does not only follow an affinity contracted by lawful matrimony, but also that contracted by a criminal commerce; with this difference, that this last does extend beyond the second generation; whereas the other, as has been observed, reaches to the fourth.

In Germany they have a kind of marriage called *morganatic*, wherein a man of quality contracting with a woman of inferior rank, he gives her the left hand in lieu of the right; and stipulates in the contract that the wife shall continue in her former rank or condition; and that the children born of them shall be of the same, so that they become bastards as to matters of inheritance, though they are legitimate in effect. They cannot bear the name or arms of the family. None but princes and great lords of Germany are allowed this kind of marriage. The universities of Leipzig and Jena have declared against the validity of such contracts; maintaining that they cannot prejudice the children, especially when the emperor's consent intervenes in the marriage.

The Turks have three kinds of marriages, and three sorts of wives; *legitimate, wives in kabin, and slaves.* They marry the first, hire the second, and buy the third.

Among all the savage nations, whether in Asia, Africa, or America, the wife is commonly bought by the husband from her father or those other relations who have an authority over her; and the conclusion of a bargain for this purpose, together with the payment of the price, has therefore become the usual form or solemnity in the celebration of their marriages. The Hebrews also purchased their wives by paying down a competent dowry for them; and Aristotle makes it one argument to prove that the ancient Grecians were an uncivilized people, because they used to buy their wives; and in proportion as they laid aside their barbarous manners they left off this practice.

The English law considers marriage in no other

light than as a civil contract; the holiness of the matrimonial state being left entirely to the ecclesiastical law, to which it pertains, to punish or annul incestuous or other unscriptural marriages. The law allows marriage to be good and valid, where the parties at the time of making it were willing and able to contract, and actually did contract, in the proper forms and solemnities required by law. The disabilities for contracting are of two sorts: first such as are canonical, and therefore sufficient by the ecclesiastical laws to void the marriage in the spiritual court; such as pre-contract, consanguinity, or relation by blood; and affinity, or relation by marriage, and some particular corporal infirmities. But these disabilities in our law do not make the marriage *ipso facto* void, but voidable only by sentence of separation; and marriages are esteemed valid to all civil purposes, unless such separation is actually made during the life of the parties. Thus when a man had married his first wife's father, and after her death the bishop's court was proceeding to annul the marriage and bastardise the issue, the court of king's bench granted a prohibition *quoad hoc*; but permitted them to proceed to punish the husband for incest.

By 32 Hen. VIII. c. 38. it is declared, that all persons may lawfully marry but such as are prohibited by God's law, &c. And that nothing (God's law excepted) shall impeach any marriage but within the Levitical degrees: these are enumerated in the 18th chapter of Leviticus, and are illustrated by Lord Coke in this manner: a man may not marry his mother, father's sister, mother's sister, sister, daughter, daughter of his son or daughter, father's wife, uncle's wife, father's wife's daughter, brother's wife, wife's sister, son's wife or wife's daughter, and daughter of his wife's son or daughter. And a woman may not marry her father, father's brother, mother's brother, brother, son, son of her husband's son or daughter, mother's husband, aunt's husband, sister's husband, husband's brother, and son of her husband's son or daughter. By the civil law first cousins are allowed to marry; but by the canon law both first and second cousins are prohibited. Therefore when it is vulgarly said that first cousins may marry but second cousins cannot, this probably arose by confounding these two laws; for first cousins may marry by the civil law, and second cousins cannot by the canon law. But by the foregoing stat. 32 Hen. VIII. c. 38. it is clear, that both first and second cousins may marry. By the same statute all impediments arising from pre-contracts to other persons were abolished, and declared of none effect unless they had been consummated with bodily knowledge; in which case the canon law holds such contract to be a marriage *de facto*. But this branch of the statute was repealed by 2 & 3 Ed. VI. c. 23. How far the act of 26 Geo II. c. 33. (which prohibits all suits in ecclesiastical courts to compel a marriage in consequence of any contract) may collaterally extend to revive this clause of Henry VIII.'s statute, and abolish the impediment of pre-contract, judge Blackstone leaves to be considered by the canonists. We shall here observe, that on a promise of marriage, if it be mutual on both sides, damages may be recovered in case either party refuses to marry; and tho' no time for the marriage is agreed on, if the plaintiff

avers

Marriage.—avers that he offered to marry the defendant who refused it, an action is maintainable for the damages; but no action shall be brought upon any agreement except it is in writing, and signed by the party to be charged. The canonical hours for celebrating marriage are from 8 to 12 in the forenoon.

The other sort of disabilities are those which are created, or at least enforced, by the municipal laws. These civil disabilities make the contract void *ab initio*, by rendering the parties incapable of forming any contract at all. The first legal disability is a prior marriage, or having another husband or wife living; in which case, besides the penalties consequent upon it as a felony, the second marriage is to all intents and purposes void. See BIGAMY and POLYGAMY.

The next legal disability is want of age: therefore if a boy under 14, or a girl under 12 years of age, marries, when either of them comes to the age of consent, they may disavow and declare the marriage void, without any divorce or sentence in the spiritual court. However, in our law it is so far a marriage, that if at the age of consent they agree to continue together, they need not be married again. Another incapacity arises from want of consent of parents or guardians. By several statutes, viz. 6 & 7 W. III. c. 6. 7. 8. W. III. c. 35. 10 Ann. c. 19. penalties of 100*l.* are laid on every clergyman who marries a couple either without publication of banns, which may give notice to parents or guardians, or without a licence, to obtain which the consent of parents or guardians must be sworn to. And by 4 & 5 Ph. & M. c. 8. whosoever marries any woman child under the age of 16 years, without consent of parents or guardians, shall be subject to fine or five years imprisonment; and her estate during her husband's life shall be enjoyed by the next heir. Thus also in France the sons cannot marry without consent of parents till 30 years of age, nor the daughters till 25; and in Holland the sons are at their own disposal at 25, and the daughters at 20. And by the marriage act, viz. 26 Geo. II. c. 33. it is enacted, that all marriages celebrated by licence (for banns suppose notice), where either of the parties is under 21, not being a widow or widower, without the consent of the father, or if he be not living of the mother or guardians, shall be absolutely void: However, provision is made where the mother or guardian is non compos, beyond sea, or unreasonably froward, to dispense with such consent at the discretion of the lord chancellor; but no provision is made in case the father should labour under any mental or other incapacity. A fourth incapacity is want of reason. It is provided by 15 Geo. II. c. 30. that the marriage of lunatics and sons under phrenies (if found lunatics under a commission or committed to the care of trustees by any act of parliament) before they are declared of sound mind by the lord chancellor, or the majority of such trustees, shall be totally void. Lastly, the parties must not only be willing and able to contract, but must actually contract themselves in due form of law, to make it a good civil marriage. Any contract made *per verba de presenti*, or in words of the present tense, and in case of cohabitation *per verba de futuro* also between persons able to contract, was before the late act deemed a valid marriage to many purposes, and

the parties might be compelled in the spiritual courts to celebrate it in *facie ecclesie*. But these verbal contracts are now of no force to compel a future marriage. Nor is any marriage at present valid that is not celebrated in some parish church, or public chapel, unless by dispensation from the archbishop of Canterbury. It must also be preceded by publication of banns or by licence from the spiritual judge. A marriage in pursuance of banns must be solemnized in one of the churches or chapels where the banns were published. No parson, vicar, &c. shall be obliged to publish banns of matrimony, unless the persons to be married shall, seven days before the time required for the first publication, deliver to him a notice in writing of their true names, and of the house or houses of their respective abode within such parish, &c. and of the time that they have dwelt in such house or houses. And the said banns shall be published upon three Sundays preceding the solemnization of marriage during the time of public service: in case the parents or guardians, or either of the parties who shall be under the age of 21 years, shall openly and publicly declare, or cause to be declared in the church or chapel where the banns shall be so published, at the time of such publication, their dissent to such marriage, such publication of banns shall be void. And when the parties dwell in divers parishes, the curate of the one parish shall not solemnize matrimony betwixt them without a certificate of the banns being thrice asked from the curate of the other parish. A marriage in pursuance of a licence (except a special licence) must be solemnized in such church or chapel where the licence is granted; and no licence of marriage shall be granted by any archbishop, bishop, &c. to solemnize any marriage in any other church, &c. than in the parish church, &c. within which the usual place of abode of one of the parties shall have been for four weeks immediately before the granting such licence. By the same statute all marriages shall be solemnized in the presence of two credible witnesses at the least, besides the minister, who shall sign their attestation thereof; and immediately after the celebration of every marriage, an entry thereof shall be made in the parish-register, expressing that the said marriage was celebrated by banns or licence; and if both or either of the parties be under age, with consent of the parents or guardians, as the case shall be, signed by the minister, and also by the parties married, and attested by the two witnesses present. It is held to be also essential to a marriage, that it be performed by a person in orders; though the intervention of a priest to solemnize this contract is merely *juris positivi*, and not *juris naturalis aut divini*; it being said that Pope Innocent III. was the first who ordained the celebration of marriage in the church, before which it was totally a civil contract. And in the times of the grand rebellion, all marriages were performed by the justices of the peace; and these marriages were declared valid without any fresh solemnization, by 12 Car. II. c. 33. But as the law now stands, we may upon the whole collect, that no marriage by the temporal law is *ipso facto* void, that is celebrated by a person in orders; in a parish-church, a public chapel, or elsewhere, by a special dispensation; in pursuance of banns or a licence; between single persons; consenting; of sound mind; and of the age of 21 years; or

Marriage of the age of 14 in males and 12 in females, with consent of parents or guardians, or without it, in case of widowhood. And no marriage is voidable by the ecclesiastical law after the death of either of the parties; nor during their lives, unless for the canonical impediments of precontract, if that indeed still exists; of consanguinity; and of affinity or corporal imbecility subsisting previous to the marriage.

By 26 Geo. II. c. 33. the substance of which has been already recited, if any person shall solemnize matrimony in any other place than a church, &c. where banns have been usually published, unless by special licence, or without publication of banns, unless licence of marriage be first obtained from some person having authority to grant the same, every such person knowingly so offending shall be guilty of felony, and transported for 14 years; the prosecution to be within three years. By the same statute, to make a false entry into a marriage-register; to alter it when made; to forge or counterfeit such entry, or a marriage li-

Marriage cence, or aid and abet such forgery; to utter the same as true, knowing it to be counterfeit; or to destroy or procure the destruction of any register in order to vacate any marriage, or subject any person to the penalties of this act; all these offences, knowingly and wilfully committed, subject the party to the guilt of felony without benefit of clergy. But this act doth not extend to the marriages of the royal family; nor to Scotland; nor to any marriages among the people called *quakers*, or among persons professing the Jewish religion, where both the parties are quakers or Jews respectively; nor to any marriages beyond the seas.

In Scotland, the parties living together as man and wife, or declaring themselves so before witnesses, makes a valid though informal marriage. See LAW, Part III. n° 160.

For the proportions which marriages bear to births, and births to burials, in several parts of Europe, Mr Derham gives us the following table.

Names of Places.

England in general	-	-	-	-
London	-	-	-	-
Hantsire, from 1569 to 1658	-	-	-	-
Tiverton in Devonshire from 1656 to 1664	-	-	-	-
Cranbrook in Kent, from 1560 to 1649	-	-	-	-
Aynho, in Northamptonshire, for 118 years	-	-	-	-
Upminster in Essex, for 100 years	-	-	-	-
Frankfort on the Maine, in 1695	-	-	-	-
Old, Middle, and Lower Marck, in 1698	-	-	-	-
Dominions of the Elector of Brandenburg, in 1698	-	-	-	-
Breslaw in Silesia, from 1687 to 91	-	-	-	-
Paris, in 1670, 1671, 1672	-	-	-	-

Marriages to Births, as	Births to Burials, as
1 to 4.63	1.12 to 1
1 to 4	1.10 to 1.1
1 to 4	1.2 to 1
1 to 3.7	1.26 to 1
1 to 3.9	1.6 to 1
1 to 6	1.6 to 1
1 to 4.6	1.8 to 1
1 to 3.7	1.2 to 1
1 to 3.7	1.9 to 1
1 to 3.7	1.5 to 1
1 to 4.7	1.6 to 1

The following Table, similar to the preceding, is formed from the observations collected and referred to by Dr Price.

Names of Places.

Marriages to Births, as

Births to Burials, as

Chambers's
Cyclopædia,
by Dr Price.

London, annual medium from 1716 to 1736	-	-	-	-
— from 1759 to 1768	-	-	-	-
Northampton, ditto, from 1741 to 1770	-	-	-	-
Norwich, ditto, from 1740 to 1769	-	-	-	-
Shrewsbury, ditto, from 1762 to 1768	-	-	-	-
Manchester and Salford, exclusive of dissenters,	-	-	-	-
Ditto, from 1755 to 1759	-	-	-	-
Ditto, ditto, including dissenters, from 1768 to 1772	-	-	-	-
Gainborough in Lincolnshire, ditto, from 1752 to 1771	-	-	-	-
Madeira, ditto, from 1759 to 1766	-	-	-	-
Boston in New England, from 1731 to 1752	-	-	-	-
Christiana in Norway, in 1761	-	-	-	-
Paris, mean of some of the last years	-	-	-	-
Vienna, annual medium from 1757 to 1769	-	-	-	-
Amsterdam, ditto, for some of the last years	-	-	-	-
Copenhagen, ditto	-	-	-	-
Berlin, ditto, for five years, ending at 1759	-	-	-	-
Breslaw, ditto, from 1633 to 1734	-	-	-	-
—, ditto, from 1717 to 1725	-	-	-	-
Rome, ditto, from 1759 to 1761	-	-	-	-
Vaud in Switzerland, ditto, for 10 years before 1766	-	-	-	-

— — —	18,000 to 26,529, or 1 to 1.4, &c.
— — —	15,710 to 22,956, or 1 to 1.4, &c.
— — —	155 to 191, or 1 to 1.2, &c.
— — —	1057 to 1206, or 1 to 1.1, &c.
— — —	301 to 329, or 1 to 1.09, &c.
— — —	756 to 743, ———
— — —	1098 to 958, or 1.14, &c. to 1.
1 to 3.7	126 to 105, or 1.2 to 1.
1 to 4.68	2201 to 1293, or 1.7 to 1.
— — —	538 to 608, or 1 to 1.13, &c.
— — —	11,024 to 6929, or 1.5 to 1.
1 to 4.3	19,100 to 19,400, or 1 to 1.01, &c.
— — —	5800 to 6600, or 1 to 1.1, &c.
1 to 1.9, &c.	4600 to 8000, or 1 to 1.1, &c.
1 to 3.04, &c.	2700 to 3300, or 1 to 1.2, &c.
1 to 3.9, &c.	3855 to 5054, or 1 to 1.3, &c.
— — —	1089 to 1256, or 1 to 1.15, &c.
— — —	1252 to 1507, or 1 to 1.2, &c.
— — —	5167 to 7153, or 1 to 1.3, &c.
1 to 3.9	3155 to 2504, or 1.2, &c. to 1.

For an account of the numbers of male and female still-born children and chrysons, and of boys and girls
N° 195.

under ten, of married men and married women, and of widows and widowers, who died for a course of years
at

Marriage. at Vienna, Breslaw, Dresden, Leipzig, Ratibon, and some other towns in Germany, see Phil. Trans. Abr. Vol. VII. Part IV. p. 46, &c.

*Chem's
Cyclop.
Dr Rect.*

The reader may find many curious calculations and remarks relating to this subject in Dr Price's excellent work, intitled, *Observations on Reverentary Payments*. From the preceding table it appears, that marriages, one with another, do each produce about four births, both in England and other parts of Europe. Dr Price observes, that the births at Paris, as may be seen in the table, are above four times the weddings; and therefore it may seem, that in the most healthy country situations, every wedding produces above four children; and though this be the case in Paris, for reasons which he has given, he has observed nothing like it in any other great town. He adds, that from comparing the births and weddings in countries and towns where registers of them have been kept, it appears, that in the former, marriages one with another seldom produce less than four children each; generally between four and five, and sometimes above five; but in towns seldom above four, generally between three and four, and sometimes under three. It is necessary to be observed here, that though the proportion of annual births to weddings has been considered as giving the true number of children derived from each marriage, taking all marriages one with another; yet this is only true, when, for many years, the births and burials have kept nearly equal. Where there is an excess of the births occasioning an increase, the proportion of annual births to weddings must be less than the proportion of children derived from each marriage; and the contrary must take place where there is a decrease: and by Mr King's computation, about one in an hundred and four persons marry; the number of people in England being estimated at five millions and a half, whereof about forty-one thousand annually marry.

In the district of Vaud in Switzerland, the married are very nearly a third part of the inhabitants.

Major Graunt and Mr King disagree in the proportions between males and females, the latter making 10 males to 13 females in London; in other cities and towns, and in the villages and hamlets, 100 males to 99 females: but Major Graunt, both from the London and country bills, computes, that there are in England 14 males to 13 females; whence he justly infers, that the Christian religion, prohibiting polygamy, is more agreeable to the law of nature than Mahometanism and others that allow it.

This proportion of males to females Mr Derham thinks pretty just, being agreeable to what he had observed himself. In the hundred years, for instance, of his own parish-register of Upminster, though the burials of males and females were nearly equal, being 633 males and 623 females in all that time; yet there were baptized 709 males and but 675 females; which is 13 females to 13.7 males.

From a register kept at Northampton for 28 years, from 1741 to 1770, it appears, that the proportion of males to females that were born in that period is 2361 to 2288, or nearly 13.4 to 13. However, though more males are born than females, Dr Price has sufficiently shown, that there is a considerable difference between the probabilities of life among males and fe-

Vol. X. Part II.

males in favour of the latter; so that males are more shortlived than females; and as the greater mortality of males takes place among children, as well as among males at all ages, the fact cannot be accounted for merely by their being more subject to untimely deaths by various accidents, and by their being addicted to the excesses and irregularities which shorten life. Mr Kerseboom informs us, that, during the course of 125 years in Holland, females have in all accidents of age lived about three or four years longer than the same number of males. In several towns of Germany, &c. it appears, that of 7270 married persons who had died, the proportion of married men who died to the married women was 3 to 2; and in Breslaw for eight years, as 5 to 3. In all Pomerania, during nine years, from 1748 to 1756, this proportion was nearly 15 to 11. Among the ministers and professors in Scotland, 20 married men die to 12 married women, at a medium of 27 years, or in the proportion of 5 to 3; so that there is the chance of 3 to 2, and in some circumstances even a greater chance, that the woman shall be the survivor of a marriage, and not a man; and this difference cannot be accounted for merely by the difference of age between men and their wives, without admitting the greater mortality of males. In the district of Vaud in Switzerland, it appears, that half the females do not die till the age of 46 and upwards, though half the males die under 36. It is likewise an indisputable fact, that in the beginning of life, the rate of mortality among males is much greater than among females.

From a table formed by Dr Price, from a register kept for 20 years at Gainsborough, it appears, that of those who live to 80, the major part, in the proportion of 49 to 32, are females. Mr Deparcieux at Paris, and Mr Wargentin in Sweden, have farther observed, that not only women live longer than men, but that married women live longer than single women. From some registers examined by Mr Muret in Switzerland, it appears, that of equal numbers of single and married women between 15 and 25, more of the former died than of the latter, in the proportion of 2 to 1.

With respect to the difference between the mortality of males and females, it is found to be much less in country parishes and villages than in towns; and hence it is inferred, that human life in males is more brittle than in females, only in consequence of adventitious causes, or of some particular debility, that takes place in polished and luxurious societies, and especially in great towns.

From the inequality above stated between the males and females that are born, it is reasonable to infer, that one man ought to have but one wife; and yet that every woman without polygamy may have a husband: this surplusage of males above females being spent in the supplies of war, the seas, &c. from which the women are exempt.

Perhaps, says Dr Price, it might have been observed with more reason, that this provision had in view that particular weakness or delicacy in the constitution of males, which makes them more subject to mortality; and which consequently renders it necessary that more of them should be produced, in order to preserve in the world a due proportion between the two sexes.

That this is a work of Providence, and not of chance,

Marriage

chance, is well made out by the very laws of chance by Dr Arbuthnot; who supposes Thomas to lay against John, that for 82 years running more males shall be born than females; and giving all allowances in the computation to Thomas's side, he makes the odds against Thomas, that it does not so happen, to be near five millions of millions of millions to one; but for ages of ages, according to the world's age, to be near an infinite number to one.

According to Mr Kerseboom's observations, there are about 32; children born from 100 marriages.

Mr Kerseboom, from his observations, estimates the duration of marriages, one with another, as in the following Table.

Those whose ages, taken together, make

40, live together between 24 and 25 years.	
50	22 23
60	23 21
70	19 20
80	17 18
90	14 15
100	12 13

Phil. Trans. N^o 468. sect. iii. p. 319.

Dr Price has shown, that on De Moivre's hypothesis, or that the probabilities of life decrease uniformly (see *COMPLEMENT of Life*), the duration of survivorship is equal to the duration of marriage, when the ages are equal; or, in other words, that the expectation of two joint lives, the ages being equal, is the same with the expectation of survivorship; and, consequently, the number of survivors, or (which is the same, supposing no second marriages) of widows and widowers, alive together, which will arise from any given set of such marriages constantly kept up, will be equal to the whole number of marriages; or half of them (the number of widows in particular) equal to half the number of marriages. Thus, the expectation of two joint lives, both 40, is the third of 46 years, or their complement, *i. e.* 15 years and 4 months; and this is also the expectation of the survivor. That is, supposing a set of marriages between persons all 40, they will one with another last just this time, and the survivors will last the same time. In adding together the years which any great number of such marriages, and their survivorships, have lasted, the sums would be found to be equal. It is observed farther, that if the number expressing the expectation of single or joint lives, multiplied by the number of single or joint lives whose expectation it is, be added annually to a society or town, the sum gives the whole number living together, to which such an annual addition would in time grow: thus, since 19, or the third of 57, is the expectation of two joint lives whose common age is 29, or common complement 57, 20 marriages every year between persons of this age would in 57 years grow to 20 times 19, or 380 marriages always existing together. The number of survivors also arising from these marriages, and always living together, would in these 57 years increase to the same number. Moreover, the particular proportion that becomes extinct every year, out of the whole number constantly existing together of single or joint lives, must, wherever this number undergoes no variation, be exactly the same with the expectation of those lives at the time when their existence commenced. Thus, if it were

Marriage.

found that a 19th part of all the marriages among any body of men, whose numbers do not vary, are dissolved every year by the deaths of either the husband or wife, it would appear, that 19 was at the time they were contracted, the expectation of these marriages. Dr Price observes, that the annual average of weddings among the ministers and professors in Scotland for the last 27 years has been 31; and the average of married persons for 17 years ending in 1767, had been 667. This number, divided by 31, gives 21½, the expectation of marriage among them; which, he says, is above 2½ years more than the expectation of marriage would be, by Dr Halley's table, on the supposition, that all first, second, and third marriages, may be justly considered as commencing one with another so early as the age of 30; and he has proved, that the expectation of two equal joint lives is to the expectation of a single life of the same age as 2 to 3: consequently, the expectation of a single life at 30, among the ministers in Scotland, cannot be less than 32.25. If we suppose the mean ages of all who marry annually to be 33 and 25, the expectation of every marriage would be 19 years; or one with another they would be all extinct in 19 years: the marriages which continue beyond this term, though fewer in number, enjoying among them just as much more duration as those that fall short of it enjoy less. But it appears from the observations and tables of Mr Muret, that, in the district of Vaud (dividing half the number of married persons, *viz.* 38,328, by the annual medium of weddings, *viz.* 808), the expectation of marriage is only 23½ years: so much higher are the probabilities of life in the country than in towns, or than they ought to be, according to De Moivre's hypothesis.

MARRIAGE (*Matrimonium*), in law, signifies not only the lawful joining of man and wife, but also the right of bestowing a ward or a widow in marriage, as well as the land given in marriage.

Dissolution of MARRIAGE. See *DIVORCE*.

Forcible MARRIAGE. See *FORCIBLE Marriage*.

Frank MARRIAGE. See *FRANK*.

Judication of MARRIAGE, in law, is one of the first and principal matrimonial causes, when one of the parties boasts or gives out, that he or she is married to the other, whereby a common reputation of their matrimony may ensue. On this ground the party injured may libel the other in the spiritual court; and unless the defendant undertakes and makes out a proof of the actual marriage, he or she is enjoined perpetual silence on that head; which is the only remedy the ecclesiastical courts can give for this injury.

MARRIAGE Settlement, is a legal act, previous to marriage, whereby a jointure is secured to the wife after the death of the husband. These settlements seem to have been in use among the ancient Germans, and their kindred nation the Gauls. Of the former Tacitus gives us this account: *Dotem non uxor maritus, sed uxori maritus offert: interfunt parentes et propinqui, et munera probant* (De Mor. Germ. c. 18.) And Cæsar, De Bell. Gallic. lib. vi. c. 18. has given us the terms of a marriage settlement among the Gauls, as nicely calculated as any modern jointure: *Viri, quantas pecunias ab uxoris dotis nomine acceperunt, tantas ex suis bonis, estimatione facta, cum dotibus communicant. Hujus omnis pecunia conjundim ratio habetur, fructusque servatur*

Uter

Marriage
|| Marru-
bium.

Mars,
Marsais.

Uter eorum vita superavit, ad eum pars utriusque cum fructibus superiorum temporum pervenit. The dauphin's commentator supposes that this Gaulish custom was the ground of the new regulations made by Justinian, Nov. 97. with regard to the provision for widows among the Romans; but surely there is as much reason to suppose, says Judge Blackstone, that it gave the hint for our statutary jointures. Comment. vol. ii. p. 138.

See an excellent marriage settlement by Blackstone in the appendix to the second volume of his Commentaries.

Duty of MARRIAGE, is a term used in some ancient customs, signifying an obligation on women to marry.

To understand this, it must be observed, that old maids and widows about sixty, who held fees in body, or were charged with any personal or military services, were anciently obliged to marry, to render those services to the lord by their husbands, or to indemnify the lord for what they could not do in person. And this was called *duty* or *service of marriage*.

Policy of encouraging MARRIAGE. Dr Halley observes, that the growth and increase of mankind is not so much stunted by any thing in the nature of the species, as it is from the cautious difficulty most people make to adventure on the state of marriage, from the prospect of the trouble and charge of providing for a family; nor are the poorer sort of people herein to be blamed, who, besides themselves and families, are obliged to work for the proprietors of the lands that feed them; and of such does the greater part of mankind consist. Were it not for the backwardness to marriage, there might be four times as many births as we find; for by computation from the table given under the article *MORTALITY*, there are 15,000 persons above 16 and under 45, of which at least 7000 are women capable of bearing children; yet there are only 1238, or little more than a sixth part of these, that breed yearly: whereas, were they all married, it is highly probable that four of six should bring forth a child every year, the political consequences of which are evident. Therefore, as the strength and glory of a kingdom or state consists in the multitude of subjects, celibacy above all things ought to be discouraged, as by extraordinary taxing or military service: and, on the contrary, those who have numerous families should be allowed certain privileges and immunities, like the *jus trium liberorum* among the Romans; and especially, by effectually providing for the subsistence of the poor.

MARROW, in anatomy, a soft oleaginous substance contained in the cavity of the bones. See *ANATOMY*, n^o 5.

MARRUBIUM, WHITE HOREHOUND: A genus of the gymnospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 42d order, *Verticillata*. The calyx is salver-shaped, rigid, and ten-lobed; the upper lip of the corolla bifid, linear, and straight. There are nine species, the most remarkable of which is the vulgar, a native of Britain, growing naturally in waste places, and by way-sides near towns and villages, but not common. It has a strong and somewhat musky smell, and bitter taste. It is reputed attenuant and resolvent; an infusion of the leaves in water, sweetened with honey, is recom-

mended in asthmatical and phthical complaints, and moist other diseases of the breast and lungs.

MARS, in astronomy, one of the five planets, and of the three superior ones; its place being between the earth and Jupiter. See *ASTRONOMY*, n^o 40.

MARS, in Pagan worship, the god of war. He was, according to some, the son of Jupiter and Juno; while others say that he was the son of Juno alone, who, being displeased at Jupiter's having produced Minerva from his brain, without female aid, in revenge conceived without the assistance of the other sex, by touching a flower shown to her by Flora in the plains of Olenus, and became the mother of this formidable deity. The amours of Mars and Venus, and the manner in which Vulcan caught and exposed them to the laughter of the other gods, have been described by several of the ancient poets. He is represented as having several wives and mistresses, and a considerable number of children. He was held in the highest veneration by the Romans, both from his being the father of Romulus their founder, and from their inclination to conquer; and had magnificent temples erected to him at Rome.

Mars is usually represented in a chariot, drawn by furious horses. He is completely armed; and extends his spear with the one hand, and grasps a sword, imbrued in blood, with the other. He has a fierce and savage aspect. Discord is represented preceding his car; and Clamour, Fear, and Terror, appear in his train. The victims sacrificed to him were the wolf, the horse, the wood-pecker, the vulture, and the cock.

MARS, among chemists, denotes *iron*; that metal being supposed to be under the influence of the planet Mars.

MARSAIS (Cesar Cheneau du), was born at Marseilles 1676. He attached himself at an early period of life to the order of the congregation of the oratory; but the situation was too narrow for his genius, and he soon left it. At Paris he married, became advocate, and entered on this new profession with great success and approbation. Disappointed, however, in his expectations of making a speedy fortune, he abandoned the law altogether. About this time the peevish humour of his wife occasioned a separation. We next find him as governor to the son of the president de Maisons; and when the premature death of the father deprived him of the fruits of his industry, he engaged with the famous Law in the same capacity. After the fall of this extraordinary projector, he completed the education of the Marquis de Beaufremont's children, and reared pupils worthy of his genius and industry. Although he was accused of a tendency to Deism, and though there was good reason for the accusation; yet he never infused into the minds of his scholars any principle inconsistent with sound morality, or with the Christian religion. When he left M. de Beaufremont's family, he took a boarding house, in which, after a method of his own, he educated a certain number of young men. Unexpected circumstances obliged him to abandon this useful undertaking. He was even contrained to give some occasional lessons for the bare necessities of life. Without fortune, without hope, and almost without resource, he was reduced to extreme indigence.

digence. In this situation he was found by the authors of the *Encyclopédie*, and made a partner in conducting that great work. Among many other excellent pieces, the article *Grammar* breathes the spirit of found philosophy. His principles are clear and solid. He discovers an extreme knowledge of the subject, great accuracy in the rules, and great propriety in the application. M. le Comte de Lauraguais was so much affected with the distresses, and so much convinced of the merit of *Du Marfais*, that he procured him a pension of one thousand livres. Du Marfais died at Paris on the 11th June 1756, in his eightieth year, after having received the sacrament. The compliment which he paid to the priest on this occasion has been considered by some as rather equivocal. But there is no necessity to deprive religion of this triumph, or philosophy of that honour which conviction and penitence must confer on it. "The faith of a great genius (says Bayle, who is intitled to credit on this subject) is not totally extinguished: It is like a spark under the ashes. Reflection and the prospect of danger call forth its exertions. There are certain situations in which philosophers are as full of anxiety and remorse as other men." Whatever were the last sentiments of Du Marfais, it cannot be denied that in the vigour of health he furnished several examples of irreligion, and to these have been added many absurd stories. The superiority of Du Marfais's talents consisted in exactness and perspicuity. His ignorance of the world, and of the customs of mankind, together with the greatest latitude in expressing whatever he thought, gave him that frank and unguarded simplicity which is often the chief ingredient of genuine humour. Fontenelle used to say of him, "that he was the most lively simpleton, and as a man of wit the most simple, he ever knew." He was the Fontaine of philosophers. In consequence of this character, he was a nice judge of what was natural in every production, and a great enemy to all kind of affectation. His principal works are, 1. *Exposition de la doctrine de l'Eglise Gallicane par rapportaux prétensions de la Cour de Rome*, 12mo. This accurate work was begun at the desire of the president de Maisons, and did not appear till after the death of the author. 2. *Exposition d'une methode raisonnée pour apprendre la langue Latine*, 12mo, 1722, rare. This method appears conformable to the natural unfolding of the powers of the mind, and on that account renders the acquisition of the language less difficult; but it was liable to two great objections to vulgar and unenlightened understandings, namely, its novelty, and the censure which it conveyed against the former method. 3. *Traité des tropes*, 1730, 8vo; again printed in 1771, 12mo. This work is intended to explain the different significations of the same word. It is a master-piece of logic, of accuracy, of perspicuity, and precision. The observations and the rules are illustrated by striking examples calculated to show both the use and the abuse of the rhetorical figures. It is wonderful at the same time that this excellent book had very little sale, and is scarcely known. A gentleman who wanted to compliment the author on this extraordinary performance, told him that he had heard a great deal of his *Histoire des Tropes*, and begged to know in what particular part of the world the nation flourished. 4. *Les véritables Principes de la Grammaire raisonnée pour apprendre la langue Latine*,

1729, 4to. There was only the preface of this work published, in which he introduced the greatest part of his *methode raisonnée*. 5. *Labège de la fable du Pere Jouvenci*, arranged after the manner of the original plan, 1731, 12mo. 6. *Une réponse manuscrite à la Critique de l'histoire des oracles par le Pere Bailus*. There are only imperfect fragments of these papers to be found.— 7. *Logique, ou réflexions sur les opérations de l'esprit*. This is a short tract, which nevertheless contains every thing necessary to be known on the art of reasoning. It was reprinted at Paris, in two parts, together with the articles which he had furnished for the *Encyclopédie*, 1762. We shall altogether omit several other performances, calculated to disseminate the principles of Deism or profanity; which, though they are published in his name, may be spurious, and at any rate deserve not to be drawn from that oblivion into which they have fallen.

MARSAL, a town of France, in Lorrain, remarkable for its salt-works; seated in a marsh on the river Selle, of difficult access, which, together with the fortifications, render it an important place. E. Long. 6. 43. N. Lat. 48. 46.

MARSALA, an ancient and strong town of Sicily, in the valley of Mazara. It is well peopled, and built on the ruins of the ancient Lilybæum. E. Long. 12. 37. N. Lat. 37. 52.

MARSAN, or MOUNT-MARSAN, a town of France, in Gascony, and capital of a small territory of the same name, fertile in wine; seated on the river Miduse, in W. Long. 0. 39. N. Lat. 44. 0.

MARSAQUIVER, or MARSAQUIVER, a strong and ancient town of Africa, on the coast of Barbary, and in the province of Beni-Arax, in the kingdom of Tremesen, with one of the best harbours in Africa. It was taken by the Spaniards in 1732. It is seated on a rock near a bay of the sea, in W. Long. 0. 10. N. Lat. 35. 40.

MARSEILLES, a strong sea-port, and the richest town of Provence, in France. Here is a good harbour, where the French galleys are stationed; for it will not admit large men of war. The entrance of the harbour, which is extremely narrow and surrounded by lofty mountains, protects and shelters vessels during the most violent storms. The port itself forms a delightful walk even in the middle of winter, as it is open to the southern sun, and crowded with vast numbers of people not only of all the European nations, but of Turks, Greeks, and natives of the coast of Barbary. The whole scene is one of the most agreeable that can be imagined, if the chains of the galley slaves heard among the hum of business did not tincture it with the hateful idea of slavery. The galleys themselves, useless and neglected, rot peaceably in their respective stations; and it is said that no others will ever be constructed to supply their place, as they have long ceased to be of any utility to the state, and are scarcely even navigable in severe weather. Marseilles pretends to the most remote antiquity; a colony of Phocians, in ages unknown, having given it birth. It is divided into the Old Town and the New; which are separated by a street, bordered with trees on each side. The Old Town is one of the most ill built of any in Europe. The New has sprung up since the commencement of the 18th century, and has all that

Marsh
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that regularity, elegance, and convenience, which distinguish the present times. It is said to contain 100,000 inhabitants, and is one of the most trading towns in France. Without the walls is the castle of Notre-Dame, which is very well fortified. It is a bishop's see, and there is a French academy; it having been noted at all times for men of learning. In 1660, Louis XIV. built the citadel and fort St John to keep the inhabitants in awe, because they pretended to be free. The Jesuits had a very fine observatory here; and in the arsenal, built not long ago, there are arms for 40,000 men. In the House of Discipline they weave gold, silver, and silk brocades. The drugs are brought thither from all parts of the world. It is seated on the north shore of the Mediterranean, in E. Long. 4. 27. N. Lat. 43. 18. The surrounding country is rocky and barren, but covered for several miles on all sides with villas and summer houses, which commerce has erected.

MARSH (Narcissus), an exemplary Irish prelate, born at Hannington in Wiltshire in 1638. He was made principal of St Alban's hall, Oxford, in 1673, but removed to the provostship of Dublin college in 1678. He was promoted to the bishopric of Leighlin and Ferns in 1682, translated to the archbishopric of Cashel in 1690, to Dublin in 1694, and to Armagh in 1703. While he held the see of Dublin, he built a noble library for the use of the public, filled it with choice books, and settled a provision for two librarians. He repaired, at his own expence, several decayed churches, besides buying in and restoring many impropriations, and presenting a great number of oriental MSS. to the Bodleian library. He was a very learned and accomplished man; was well versed in sacred and profane literature, in mathematics, natural philosophy, the learned languages, especially the oriental, and in both the theory and practice of music. He published, 1. *Institutiones logicæ*.—2. *Manuductio ad logicam*, written by Philip de Trieu; to which he added the Greek text of Ari-Rotle, and some tables and schemes. —3. An introductory essay on the doctrine of sounds, &c. He died in 1713.

MARSH, signifies a piece of ground flowed with water, yet so that the grafs and other vegetables rise above the surface of the water, and, by their decaying, give rise to putrid effluvia, which are very pernicious to the human body.

MARSHAL, or MARESCHAL, (*marescallus*), primarily denotes an officer who has the care or the command of horses.—Nicod derives the word from *pole-marchus*, "mafter of the camp;" Matthew Paris from *Martis fenescallus*. In the old Gaulish language, *march* signified "horse;" whence *mareschal* might signify "him who commanded the cavalry." Other derivations have been given by different authors; and the name itself has been applied to officers of very different employments.

MARSHAL of France, the highest dignity of preferment in the French armies. The dignity of marshal came to be for life, though at its first institution it was otherwise. They were then only the king's first ecuyers under the constable; but in time they became the constable's lieutenants in the command of the army, the constable himself being then become cap-

tain-general. At first they were but two in number; and their allowance was but 500 livres *per annum* in time of war, and nothing in time of peace: but in the reign of Francis I. a third was added; Henry II. created a fourth. Since it has been various; Louis XIV. increased it to 20. Their office at first was, to marshal the army under the constable, and to command in his absence. They did then what the *marshals de camp* do now; to which last they have given their title, and the least considerable part of their authority.

Earl MARSHAL of Scotland. His office was to command the cavalry, whereas the CONSTABLE commanded the whole army. They seem, however, to have had a sort of joint command, as of old all orders were addressed "to our constable and marshal." The office of earl marshal has never been out of the noble family of Keith. It was referred at the union; and when the heritable jurisdictions were bought, it was in the crown, being forfeited by the rebellion of Geo. Keith, earl marshal, in 1715.

Earl MARSHAL of England is the eighth great officer of state. This office, until it was made hereditary, always passed by grant from the king, and never was held by tenure or serjeanty (by any subject) as the offices of lord high steward and lord high constable were sometimes held. The title is personal, the office honorary and officary. They were formerly styled *lord marshal* only, until king Richard II. June 20. 1397, granted letters-patent to Thomas Mowbray, earl of Nottingham, and to the heirs male of his body lawfully begotten, by the name and style of *earl marshal*; and further, gave them power to bear in their hand a gold truncheon, enamelled with black at each end; having at the upper end of it the king's arms engraven thereon, and at the lower end his own arms.

King James I. was pleased, by letters-patent, dated August 29th 1622, to constitute Thomas Howard, earl of Arundel and Surrey, earl marshal for life; and the next year, the same king granted (with the advice of the privy-council) letters-patent, wherein it was declared, that during the vacancy of the office of lord high constable of England, the earl marshal had the like jurisdiction in the court of chivalry, as both constable and marshal jointly ever exercised. See CHIVALRY (Court of.)

On the 19th of October 1672, king Charles II. was pleased to grant to Henry lord Howard, and the heirs-male of his body lawfully begotten, the office and dignity of earl marshal of England, with power to execute the same by deputy or deputies, in as full and ample a manner as the same was heretofore executed by Henry Howard, lord Maltravers, late earl of Arundel, Surrey, and Norfolk, grandfather to the said Henry lord Howard; or by Thomas Howard late duke of Norfolk, grandfather to the said Thomas Howard, late earl of Arundel, Surrey, and Norfolk; or by Thomas Howard duke of Norfolk, grandfather of the said Thomas Howard duke of Norfolk; or by John Mowbray duke of Norfolk, or any other earl marshal of England; with a pension of £. 20 each year, payable out of the Hanaper office in chancery; and on default of the issue-male of the said Henry lord Howard,

Howard,

Marthal.

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Howard, with limitation to the heirs-male lawfully begotten of the body of the said Thomas Howard, earl of Arundel, &c.; and, on the default of such issue, to descend in like manner to the heirs-male of Thomas late earl of Suffolk; and, on default of his issue-male, to the heirs-male of lord William Howard, late of Naworth in the county of Cumberland, youngest son to Henry Howard late duke of Norfolk; and, on default of his issue-male, to Charles Howard earl of Nottingham, and the heirs-male of his body lawfully begotten.

Field-MARSHAL, an office of high rank in the European armies. It is now, however, disused in the British army; Lord Trawley was the last, appointed in 1763.

Knight MARSHAL, or *MARSHAL of the King's House*, an English officer, whose business, according to Fleta, is to execute the commands and decrees of the lord steward, and to have the custody of prisoners committed by the court of verge. Under him are six marshal's men, who are properly the king's bailiffs, and arrest in the verge of the court, when a warrant is backed by the board of green-cloth. The court where causes of this kind, between man and man, are tried, is called the *Marshall's*, and is under the knight-marshal. See *MARSHALSEA*.

This is also the name of the prison in Southwark; the reason of which may probably be, that the marshal of the king's house was wont to sit there in judgement, or keep his prison.

MARSHAL of the King's Bench, an officer who has custody of the prison called the *King's Bench* in Southwark.—He gives attendance upon the court, and takes into his custody all prisoners committed by the court; he is fineable for his absence, and non-attendance incurs a forfeiture of his office. The power of appointing the marshal of the king's bench is in the crown.

In Fleta, mention is also made of a *marshal of the exchequer*, to whom the court commits the custody of the king's debtors, &c.

MARSHAL (Thomas), a very learned English divine in the 17th century, was educated at Oxford. This city being garrisoned upon the breaking out of the civil wars, he bore arms for the king. Afterward he had several successive preferments in the church; and died at Lincoln-college, of which he was rector. By his will he left all his books and MSS. to the university of Oxford, and money to Lincoln-college for the maintenance of three scholars. He was a noted critic, especially in the Gothic and English-Saxon tongues; and eminent for his piety and other valuable qualities. He wrote, 1. *Observations in Evangeliorum versiones per antiquos duos, Galb. scilicet & Anglo-Sax.* &c. 2. *Notes on the church-catechism*, &c.

MARSHALLING a *COAT*, in heraldry, is the disposal of several coats of arms belonging to distinct families in one and the same escutcheon or shield, together with their ornaments, parts, and apurtenances. See *HERALDRY*, chap. vi. p. 466.

MARSHALSEA (*the Court of*), and the *Palace-court* at Westminster, though two distinct courts, are frequently confounded together. The former was originally holden before the steward and marshal of the king's house, and was instituted to administer justice between the king's domestic servants, that they

might not be drawn into other courts, and thereby the king lose their service. It was formerly held in, though not a part of, the *aula regis*; and, when that was subdivided, remained a distinct jurisdiction: holding plea of all trespasses committed within the verge of the court, where only one of the parties is in the king's domestic service (in which case the inquest shall be taken by a jury of the country); and of all debts, contracts, and covenants, where both of the contracting parties belong to the royal household; and then the inquest shall be composed of men of the household only. By the statute of 13 Ric. II. ft. 1. c. 3. (in affirmance of the common law); the verge of the court in this respect extends for 12 miles round the king's place of residence. And, as this tribunal was never subject to the jurisdiction of the chief judiciary, no writ of error lay from it (though a court of record) to the king's bench, but only to parliament, till the statutes of 5 Edw. III. c. 2. and 10 Edw. III. ft. 2. c. 3. which allowed such writ of error before the king in his place. But this court being ambulatory, and obliged to follow the king in all his progresses, so that by the removal of the household actions were frequently discontinued, and doubts having arisen as to the extent of its jurisdiction, king Charles I. in the sixth year of his reign, by his letters-patent, erected a new court of record, called the *curia palatii*, or *palace-court*, to be held before the steward of the household and knight-marshal, and the steward of the court, or his deputy; with jurisdiction to hold plea of all manner of personal actions whatsoever, which shall arise between any parties within 12 miles of his majesty's palace at Whitehall. The court is now held once a week, together with the ancient court of marshalsea, in the borough of Southwark; and a writ of error lies from thence to the court of king's bench. But if the cause is of any considerable consequence, it is usually removed on its first commencement, together with the custody of the defendant, either into the king's bench or common-pleas by a writ of *habeas corpus cum causa*: and the inferior business of the court hath of late years been much reduced, by the new courts of conscience erected in the environs of London; in consideration of which the four counsel belonging to these courts had salaries granted them for their lives by the stat. 23. Geo. II. c. 27.

MARSHAM (Sir John), a very learned English writer in the 17th century. He studied the law in the Middle-Temple, and was sworn one of the six clerks in the court of chancery in 1638. In the beginning of the civil wars he followed the king to Oxford; for which he was sequestered of his place by the parliament at Westminster, and plundered. After the declining of the king's affairs, he returned to London; compounded, among other royalists, for his real estate; and betook himself wholly to his studies and a retired life, the fruits of which were some excellent works. He wrote *Diatriba Chronologica*; *Chronicus Canon*; *Aegyptiacus*, *Ebraicus*, *Grecus*, &c. He died in 1685.

MARSHFIELD, a town of Gloucestershire, 7 miles from Bath, 12 from Chipping-Sodbury, 12½ from Bristol, 35 from Gloucester, and 104 from London, on the road to Bristol, and on the very borders of Wilts. It is a considerable clothiug-town, drives

Mar-shalica
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Marshfield

Marshland a good trade in malt, and is famous for cakes. It consists chiefly of one street of old buildings near a mile long; and is governed by a bailiff. It has a large church, with a well-endowed alms-house and a chapel to it for eight poor people, and a charity-school; and it has a weekly market and two fairs.

Marigli.

MARSHLAND, a marshy peninsula in the county of Norfolk, opposite to King's-Lynn, almost surrounded with the Ouse and other navigable rivers, and an arm of the sea. It seems formerly to have been recovered out of the ocean, from whose inundations it could never be altogether defended; and in Sir Henry Spelman's time it suffered two general ones, viz. one from the salt-water, the other from the freshes; by the last of which the inhabitants suffered 42,000 l. damage. It contains about 30,000 acres, which turn to more profit by grazing than ploughing. It is about 10 miles in the widest place, and has no less than 111 brick bridges. The commonage of it belongs to seven villages that surround it. The air is so unhealthy, that an ague is commonly called the *Marshland-bailiff*.

MARSHMALLOW, in botany. See *ALTHÆA*.

MARSI, a nation of Germany, who afterwards came to settle in Italy, where they occupied the territory in the environs of the Fucine Lake. They at first proved very inimical to the Romans, but in process of time they became its firmest supporters. They were allowed by the Romans to be the most intrepid soldiers of their legions when in friendship, and the most formidable of their enemies when at variance; and it was a common saying, that Rome could neither triumph over the Marfi nor without them. They are particularly celebrated for the civil war in which they were engaged, and which from them has received the name of the *Marfan war*. The large contributions they made to support the interest of Rome, and the number of men which they continually supplied to the republic, rendered them bold and aspiring; and they claimed, with the rest of the Italian states, a share of the honour and privileges which were enjoyed by the citizens of Rome. This petition, though supported by the interest, the eloquence, and the integrity of the tribune Drusus, was received with contempt by the Roman senate; upon which, in the 662d year of Rome, the Marfi put themselves at the head of the social war, one of the most obdurate and dangerous oppositions ever made to the progress of the Roman power. They obtained several victories: but they were at last defeated: though the war was not terminated but by a grant of those privileges for which they contended.

MARSICO NUOVO, a small, rich, and handsome town of Italy, in the kingdom of Naples, and in the Hither Principato, with a bishop's see. It is seated at the foot of the Apennines, near the river Agri, in E. Long. 15. 40. N. Lat. 40. 42.

MARSIGLI (Lewis Ferdinand, count), an Italian famous for letters as well as arms, was defended from an ancient and noble family, and born at Bologna in 1658. He acquired a great knowledge in the art of war and fortification; served under the emperor Leopold II. against the Turks, by whom he was taken prisoner in 1683 but redeemed, after a year's captivity. In the Spanish succession war, Mar-

figli, then advanced to the rank of marshal, being in the fortress of Briſac, which surrendered to the duke of Burgundy in 1703, when the place was deemed capable of holding out much longer, was stripped of all his commissions, and had his sword broke over him; and the count d'Arco who commanded was beheaded. Marfigli now sought for consolation in the sciences; as, amidst all the hurry and fatigue of war, he had made all the advantages the most philosophic man could do, who had travelled purely in quest of knowledge. He had a rich collection of every thing proper to the advancement of natural knowledge, instruments astronomical and chemical, plans of fortifications, models of machines, &c. all which he presented to the senate of Bologna by an authentic act in 1712, forming at the same time out of them what he called the *institute of the arts and sciences at Bologna*. He also founded a printing-house, and furnished it with the best types for Latin, Greek, Hebrew, and Arabic, which he presented in 1728 to the Dominicans at Bologna, on condition of their printing all the writings of the *institute* at prime cost: this was called the *printing-house of St Thomas Aquinas*. His writings on philosophical subjects are numerous and valuable, in Latin, Italian, and French: he died in 1730.

MARSTON (John), an English dramatic writer, who lived in the time of James I. Wood says he was a student in Corpus Christi college, Oxford; but we neither know his family nor the time of his birth. He contributed eight plays to the stage, which were all acted at Black-friars with applause; and one of them, called the *Dutch Courtesan*, was once revived since the Restoration, under the title of the *Revenge*, or a *Match in Newgate*. There is no account when he died; but we find his works were published after his death by Shakespeare, and may thence reasonably conclude that it happened about the year 1614. He was a chaste and pure writer; avoiding all that obscenity, ribaldry, and scurrility, which too many of the play-wrights of that time, and indeed much more so in some periods since, have made the basis of their wit, to the great disgrace and scandal of the stage.

MARSYAS (fab. hist.), a celebrated musician of Celæne in Phrygia, son of Olympus, or of Hyagnis, or Cægrus. He was so skilful in playing on the flute, that he is generally deemed the inventor of it. According to the opinion of some, he found it when Minerva had thrown it aside on account of the distortion of her face when she played upon it. Marfyas was enamoured of Cybele, and he travelled with her as far as Nyssa, where he had the imprudence to challenge Apollo to a trial of his skill as a musician. The god accepted the challenge, and it was mutually agreed: that he who was defeated should be dead alive by the conqueror. The Muses, or (according to Diodorus) the inhabitants of Nyssa, were appointed umpires. Each exerted his utmost skill, and the victory with much difficulty was adjudged to Apollo. The god upon this tied his antagonist to a tree, and dead him alive: (See *APOLLO*.) The death of Marfyas was universally lamented; the Fauns, Satyrs, and Dryads, wept at his fate; and from their abundant tears arose a river of Phrygia, well known by the name of *Marfyas*.

Marthen, Marfyas.

Mart
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Martha.

fyas. The unfortunate Marfyas is often represented on monuments, as tied with his hands behind his back to a tree, while Apollo stands before him with his lyre in his hands. In independent cities, among the ancients, the statue of Marfyas was generally erected in the forum, to represent the intimacy which subsisted between Boccus and Marfyas as the emblems of liberty. At Celæne, the kin of Marfyas was shown to travellers for some time. It was suspended in the public place, in the form of a bladder or a foot ball.

The sources of the Marfyas were near those of the Meander, and those two rivers had their confluence a little below the town of Celæne.

MART, a great fair held every year for buying and selling goods. Public marts, or places of buying and selling, such as markets and fairs, with the tolls thereunto belonging, can only be set up by virtue of the king's grant, or by long and immemorial usage and prescription, which presupposes such a grant. The limitation of these public resorts, to such time and place as may be most convenient for the neighbourhood, forms a part of economics, or domestic policy; which, considering the kingdom as a large family, and the king as the master of it, he has clearly a right to dispose and order as he pleases.

MARTABAN, a province of Asia, in the kingdom of Pegu, lying in the gulph of Bengal. It is a country that produces rice and all kinds of fruits proper to the climate. It has mines of several sorts of metals, and carries on a great trade. The chief town, which is of the same name, is rich, handsome, and very populous, with a good harbour. E. Long. 97. 50. N. Lat. 15. 35.

MARTEAU, the name given by French naturalists to a peculiar species of oysters, called also *malleum* by others. It is one of the most curious shells in the world. Its figure is that of a hammer, with a very long head, or rather of a pick-ax. It has a body of moderate thickness, and two long arms. It is of a brownish colour, with a beautiful tinge of a violet-blue. Notwithstanding the strange shape of these shells, they close very exactly.

MARTHA (St), a province of South America, on the coast of Terra Firma, bounded on the north by the North Sea, on the east by Rio de la Hache, on the south by New-Granada, and on the west by Carthæna. It is 300 miles in length and 200 in breadth, is a mountainous country, and the land very high. Here begins the famous ridge of mountains called the *Cordillera de los Andes*, which run from north to south the whole length of the continent of South America. It is extremely hot on the sea-coast; but cold in the internal parts, on account of the mountains. It abounds with the fruits proper to the climate; and there are mines of gold and precious stones, as also salt-works. The Spaniards possess but one part of this province, in which they have built Martha the capital. The air about the town is wholesome; and is seated near the sea, having a harbour surrounded with high mountains. It was formerly very considerable when the galleons were sent thither, but is now come almost to nothing. W. Long. 74. 11. N. Lat.

11. 20.

MARTHA (St), or *Sierra Nevada*, a very high mountain in New Spain. Some say it is 100 miles in N^o 195.

circumference at the bottom, and five miles in height. The top is always covered with snow in the hottest weather; and the French affirm, that they can perceive it from the island of St Domingo, which is 370 miles distant. W. Long. 74. 35. N. Lat. 8. 0.

MARTHA'S Vineyard, an island of North America near the coast of New-England, 80 miles south of Boston. The inhabitants apply themselves chiefly to their fisheries, in which they have great success. W. Long. 70. 35. N. Lat. 41. 0.

MARTIAL, is sometimes used to express preparations of iron, or such as are impregnated therewith; as the martial regulus of antimony, &c.

MARTIAL-COURT. See *Court-Martial*.

MARTIAL LAW, is the law of war that depends upon the just but arbitrary will and pleasure of the king, or his lieutenant: for though the king doth not make any laws but by common consent in parliament, yet, in time of war, by reason of the necessity of it to guard against dangers that often arise, he useth absolute power, so that his word is a law. *Smith de Repub. Ang. lib. 2. c. 4.*

But the martial law (according to Chief Justice Hale), is in reality not a law, but something indulged rather than allowed as a law; and it relates only to members of the army, being never intended to be executed on others, who ought to be ordered and governed by the laws to which they are subject, though it be a time of war. And the exercise of martial law, whereby any person might lose his life, or member, or liberty, may not be permitted in time of peace, when the king's courts are open for all persons to receive justice.

MARTIALIS (Marcus Valerius), a famous Latin poet, born at Bilbilis, now called *Bubiera*, in the kingdom of Arragon in Spain, was of the order of knights. He went to Rome at the age of 21, and staid there 35 years, under the reign of Galba and the succeeding emperors, till that of Trajan; and having acquired the esteem of Titus and Domitian, he was created tribune. At length, finding that he was neglected by Trajan, he returned to his own country Bilbilis, where he married a wife, and had the happiness to live with her several years. He admires and commends her much, telling her that she alone was sufficient to supply the want of every thing he enjoyed at Rome. "*Romam tu mihi sola facis*," says he, in the 21st epigram of the 12th book. She appears likewise to have been a lady of a very large fortune; for, in the 31st epigram of the same book, he extols the magnificence of the house and gardens he had received from her, and says that she had made him a little kind of monarch."

Munera sunt domino: post septima iustra revere,

Hæc Marcella domos, parvæque regna dedit.

There are still extant 14 books of his epigrams, filled with points, a play upon words, and obscenities. The style is affected. However, some of his epigrams are excellent; many of them are of the middling kind; but the greatest part of them are bad: so that Martial never spoke a greater truth, than when he said of his own works,

Sunt bona, sunt quedam mediocræ, sunt mala plura.

There is also attributed to him a book on the spectacles of the amphitheatre; but the most learned critics

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Marialis.

Martigues, *Martin*. ties think that this last work was not written by Martial. The best editions of Martial are, that in *Usum Delphini*, 4to, Paris, 1617, and that *cum Notis Variarum*.

MARTIGUES, a sea-port town of France, in Provence, with the title of a principality; seated near a lake 12 miles long and five broad, which is navigable throughout, and from whence they get excellent salt. E. Long. 4. 20. N. Lat. 43. 38.

MARTIN (St.), was born at Sabaria in Pannonia, (at present *Stain* in Lower Hungary), in the beginning of the fourth century. His father was a military tribune; and he himself was obliged to carry arms, although peace and solitude were much more agreeable to his inclination. He was remarkable for every virtue, in a profession which is generally considered to give a sanction to vice. He divided his coat with a naked wretch whom he met at the gate of Amiens; and it is reported, that Jesus Christ appeared to him on the night following, clothed in this half of his coat. Martin was then a catechumen; but he soon afterwards received baptism, and renounced the military profession for the ecclesiastical. After passing many years in solitude, St Hilary bishop of Poitiers gave him the power to cast out devils. On his return to Pannonia, he persuaded his mother to embrace Christianity; and with great zeal and activity opposed the Arians, who governed the church in Illyria. When he was publicly whipt for giving testimony to the divinity of Christ, he bore the punishment with the constancy and patience of the first martyrs. This illustrious champion for Christianity, when he heard that St Hilary was returned from banishment, went and settled in the neighbourhood of Poitiers. In this retirement, a great number of monks placed themselves under his direction. His virtues became every day more splendid and remarkable, till he was drawn from this solitude, and with the general approbation of the clergy and people elected bishop of Tours in the year 374. To the zeal and charity of a bishop, he joined the humility and poverty of an anchorite. That he might detach himself more from the world, he built the celebrated monastery of Marmoutier, which still remains, and which is believed to be the oldest abbey in France. It is situated near the city of Tours, betwixt the Loire and a steep rock. In this situation, together with 80 monks, St Martin displayed the most exemplary sanctity and mortification, nor were there any monks better disciplined than those of Marmoutier. After he had converted his diocese to the Christian faith, he became the apostle of all Gaul. He diffused the doctrines of Christianity among the heathens, destroyed their temples, and (according to the writers of his life) confirmed the truth by an infinite number of miracles. The emperor Valentinian, at that time in Gaul, received him with every mark of respect and honour. The tyrant Maximus, who had revolted against the emperor Gratian, and seized on Spain, England, and Gaul, received him in a manner no less distinguished. The holy bishop attended him at Trèves in the year 383, to solicit some favours. Maximus made him sit at his table with the most illustrious persons of his court, and placed him at his right hand. In drinking, the

usurper commanded his servants to give him a cup, that he might again receive it from him; but this extraordinary prelate gave it to the priest who accompanied him on his journey. This holy boldness, far from displeasing them, gained him the favour of the emperor and of his court. Martin, who was an enemy to heresy, but a friend to mankind, employed his influence with this prince to preserve the Priscillianists, who were persecuted by Ithace and by Ildace, bishops of Spain. The bishop of Tours would hold no communion with men whose principles of religion inclined them to shed the blood of mankind; and he obtained the life of those whose death they had solicited. On his return to Tours, he prepared himself for the reward of his labours in another world. He died at Candes the 8th of November 397, but according to others on the 11th of November 400. His name is given to a particular opinion concerning the mystery of the holy Trinity. St Martin is the first of the faints confessors to whom the Latin church offered public prayers. His life is written in elegant Latin by Fortunatus, and Sulpitius Severus one of his disciples. Paul of Perigueux and Fortunatus of Poitiers have given us Sulpicius's life of Martin in verse; but they have debased the admirable prose of the author by a wretched poetical imitation. Nicolas Gervais wrote also the life of St Martin, full of many curious and entertaining facts, published at Tours in 1699, in 4to. The tradition at Amiens is, that St Martin performed the act of charity which rendered him so famous, near an ancient gate of the city, of which the ruins are still visible. The following Latin verses, which do more honour to the saint than to the poet, are inscribed on one of the stones:

*Hic quondam vestem Martinus demidavit;
Ut faceremus idem, nobis exemplificavit.*

MARTIN (Benjamin), one of the most eminent artists and mathematicians of the age, was born in 1704. After publishing a variety of ingenious treatises, and particularly a Scientific Magazine under his own name, and carrying on for many years a very extensive trade as an optician and globe-maker in Fleet-street, the growing infirmities of age compelled him to withdraw from the active part of business. Trusting too fatally to what he thought the integrity of others, he unfortunately, though with a capital more than sufficient to pay all his debts, became a bankrupt. The unhappy old man, in a moment of desperation from this unexpected stroke, attempted to destroy himself; and the wound, though not immediately mortal, hastened his death, which happened February 9th 1782, in his 77th year. He had a valuable collection of fossils and curiosities of almost every species; which, after his death, were almost given away by public auction. His principal publications, as far as they have occurred to recollection, are, *The Philosophic Grammar*; being a view of the present state of experimental physiology, or natural philosophy, 1735, 8vo. *A new, complete, and universal System or Body of Decimal Arithmetic*, 1735, 8vo. *The young Students Memorial Book, or Patent Library*, 1735, 8vo. *Description and Use of both the Globes, the Armillary Sphere and Orrery, Trigonometry*, 1736, 2 vols 8vo.

Martin.

Martin
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Martinico

Memoirs of the Academy of Paris, 1740, 5 vols. System of the Newtonian Philosophy, 1759, 3 vols. New Elements of Optics, 1759. Mathematical Institutions, viz. Arithmetic, Algebra, Geometry, and Fluxions, 1759. Natural History of England, with a Map of each County, 1759, 2 vols. Philology, and Philosophical Geography, 1759. Mathematical Institutions, 1764, 2 vols. Lives of Philosophers, their Inventions, &c. 1764. Introduction to the Newtonian Philosophy, 1765. Institutions of Astronomical Calculations, 2 parts, 1765. Description and Use of the Air-pump, 1766. Description of the Torricellian Barometer, 1766. Appendix to the Description and Use of the Globes, 1766. Philosophia Britannica, 1778, 3 vols. Gentleman and Lady's Philology, 3 vols. Miscellaneous Correspondence, 4 vols. System of Philology. Philosophical Geography. Magazine complete, 14 vols. Principles of Pump-work. Theory of the Hydrometer. Doctrine of Logarithms.

MARTIN (St.), a small but strong town of France, in the isle of Rhé, with a harbour and a strong citadel, fortified after the manner of Vauban. The island lies near the coast of Poitou. W. Long. 1. 0. N. Lat. 45. 40.

Cape MARTIN, a promontory of Valencia in Spain, near a town called *Denia*, and separates the gulph of Valencia from that of Alicante.

MARTIN (St.), an island of America, and one of the Caribbees, lying on the gulph of Mexico, to the north-west of St Bartholomew, and to the south-west of Anguilla. It is 42 miles in circumference; has neither harbour nor river, but several salt-pits. After various revolutions, it is at length in possession of the French and Dutch, who possess it conjointly. W. Long. 62. 35. N. Lat. 18. 15.

MARTIN, in zoology. See *HIRUNDO* and *MUSTELA*.

Free MARTIN, in zoology, is a name given to this country to a cow-calf cast at the same time with a bull-calf, which is a kind of hermaphrodite that is never known to breed nor to discover the least inclination for the bull, nor does the bull ever take the least notice of it. See *HERMAPHRODITE*.

MARTINGALE, in the manege, a thong of leather, fastened to one end of the girths under a horse's belly, and at the other end to the muls-roll, to keep him from rearing.

MARTINICO, the chief of the French Caribbee islands, the middle of which is situated in W. Long. 61. 0. N. Lat. 14. 30.

This island was first settled by M. Desnambuc a Frenchman, in the year 1635, with only 100 men from St Christopher's. He chose rather to have it peopled from thence than from Europe; as he foresaw, that men, tired with the fatigue of such a long voyage, would mostly perish soon after their arrival, either from the climate, or from the hardships incident to most emigrations. They completed their first settlement without any difficulty. The natives, intimidated by their fire-arms, or seduced by promises, gave up the western and southern parts of the island to the new comers. In a short time, however, perceiving the number of these enterprising strangers daily increasing,

Martinico.

they resolved to extirpate them, and therefore called in the savages of the neighbouring islands to assist them. They fell jointly upon a little fort that had been hastily erected; but were repulsed, with the loss of 700 or 800 of their best warriors, who were left dead upon the spot.

After this check, the savages for a long time disappeared entirely; but at last they returned, bringing with them presents to the French, and making excuses for what had happened. They were received in a friendly manner, and the reconciliation sealed with pots of brandy. This peaceable state of affairs, however, was of no long continuance; the French took such undue advantages of their superiority over the savages, that they soon rekindled in the others that hatred which had never been entirely subdued. The savages, whose manner of life requires a vast extent of land, finding themselves daily more and more straitened, had recourse to stratagem, in order to destroy their enemies. They separated into small bands, and way-laid the French as they came singly out into the woods to hunt, and, waiting till the sportsman had discharged his piece, rushed upon and killed him before he could charge it again. Twenty men had been thus assassinated before any reason could be given for their sudden disappearance: but as soon as the matter was known, the French took a severe and fatal revenge; the savages were pursued and massacred, with their wives and children, and the few that escaped were driven out of Martinico, to which they never returned.

The French being thus left sole masters of the island, lived quietly on those spots which best suited their inclinations. At this time they were divided into two classes. The first consisted of those who had paid their passage to the island, and these were called *inhabitants*; and to these the government distributed lands, which became their own, upon paying a yearly tribute. These inhabitants had under their command a multitude of disorderly people brought over from Europe at their expense, whom they called *engagés*, or bondsmen. This engagement was a kind of slavery for the term of three years; on the expiration of which they were at liberty, and became the equals of those whom they had served. They all confined themselves at first to the culture of tobacco and cotton; to which was soon added that of arnotto and indigo. The culture of sugar also was begun about the year 1650. Ten years after, one Benjamin D'Acosta, a Jew, planted some cocoa trees; but his example was not followed till 1684, when chocolate was more commonly used in France. Cocoa then became the principal support of the colonists, who had not a sufficient fund to undertake sugar-plantations; but by the inclemency of the season in 1718, all the cocoa-trees were destroyed at once.—Coffee was then proposed as a proper object of culture. The French ministry had received, as a present from the Dutch, two of these trees, which were carefully preserved in the king's botanical garden. Two young shoots were taken from these, put on board a ship for Martinico, and entrusted to the care of one Mr Desclieux. The ship happened to be straitened for want of fresh water; and the trees would have perished, had not the gentleman shared

with

Martinico. with them that quantity of water which was allowed for his own drinking. The culture of coffee was then begun, and attended with the greatest and most rapid success. About the end of last century, however, the colony had made but small advances. In 1700, it had only 6597 white inhabitants. The savages, mulattoes, and free negroes, men, women, and children, amounted to no more than 507. The number of slaves was but 14,566. All these together made a population of 21,645 persons. The whole of the cattle amounted to 3668 horses or mules, and 9217 head of horned cattle. The island produced a great quantity of cocoa, tobacco, and cotton; had nine indigo houses, and 183 small sugar-plantations.

After the peace of Utrecht, Martinico began to emerge from that feeble state in which it had so long continued. The island then became the mart for all the windward French settlements. In the ports of it the neighbouring islands sold their produce, and bought the commodities of the mother-country; and, in short, Martinico became famous all over Europe. In 1736, there were on the island 447 sugar works; 11,953,232 coffee trees, 193,870 of cocoa; 2,068,480 plants of cotton, 30,400 of tobacco, 67,000 of arnotto. The supplies for provision consisted of 4,806,142 banana trees; 34,483,000 trenches of cassava; and 247 plots of potatoes and yams. The number of blacks amounted to 72,000 men, women, and children. Their labour had improved the plantations as far as was consistent with the consumption then made in Europe of American productions; and the annual exports from the island amounted to about 700,000 l.

The connections of Martinico with the other islands entitled her to the profits of commission, and the charges of transport; as the alone was in the possession of carriages. This profit might be rated at the tenth of the produce; and the sum total must have amounted to near 765,000 l. This standing debt was seldom called in, and left for the improvement of their plantations. It was increased by advances in money, slaves, and other necessary articles; so that Martinico became daily more and more a creditor to the other islands, and thus kept them in constant dependence; while they all enriched themselves by her assistance.

The connections of this island with Cape Breton, Canada, and Louisiana, procured a market for the ordinary sugars, the inferior coffee, the molasses, and rum, which would not sell in France. In exchange the inhabitants received salt-fish, dried vegetables, deals, and some flour. In the clandestine trade on the coasts of Spanish America, consisting wholly of goods manufactured by the nation, the commonly made a profit of 90 per cent. on the value of about 175,000 l. sent yearly to the caracacs, or neighbouring colonies.

So many prosperous engagements brought immense sums into Martinico. Upwards of 787,000 l. were constantly circulated in that island with great rapidity; and this is perhaps the only country in the world, where the specie has been so considerable as to make it a matter of indifference to them whether they dealt in gold, silver, or commodities. This extensive trade brought into the ports of Martinico annually 200 ships from France; 14 or 15 fitted out by the mother-country for the coast of Guineæ, 60 from Canada, 10

or 12 from the islands of Margarettæ and Trinidad; besides the English and Dutch ships that came to carry on a smuggling trade. The private navigation from the island to the northern colonies, to the Spanish continent, and to the windward islands, employed 120 vessels from 20 to 30 tons burden.

The war of 1744 put a stop to this prosperity. Not that the fault was in Martinico itself; its navy, constantly exercised, and accustomed to frequent engagements, which the carrying on a contraband trade required, was prepared for action. In less than six months, 40 privateers, fitted out at St Peter's, spread themselves about the latitude of the Caribbee islands. They signalled themselves in a manner worthy of the ancient freebooters; returning constantly in triumph, and laden with an immense booty. Yet, in the midst of these successes, an entire stop was put to the navigation of the colony, both to the Spanish coast and to Canada, and they were constantly disturbed even on their own coasts. The few ships that came from France, in order to compensate the hazards they were exposed to by the loss of their commodities, sold them at a very advanced price, and bought them at a very low one. By this means the produce decreased in value, the lands were left uncultivated, the works neglected, and the slaves perishing for want.

When every thing thus seemed tending to decay, the peace at last restored the freedom of trade, and with it the hopes of recovering the ancient prosperity of the island. The event, however, did not answer the pains that were taken to attain it. Two years had not elapsed after the cessation of hostilities, when the colony lost the contraband trade she carried on with the American Spaniards. This was owing to the substitution of regular-ships to the fleets; and thus were the attempts of the smugglers confined within very narrow bounds. In the new system, the number of ships was undetermined, and the time of their arrival uncertain: which occasioned a variation in the price of commodities unknown before; and from that time the smuggler, who only engaged in this trade from the certainty of a fixed and constant profit, would no longer pursue it, when it did not secure him an equivalent to the risks he ran. But this loss was not so sensibly felt by the colony, as the hardships brought upon them by the mother-country. An unskillful administration clogged the reciprocal and necessary connection between the Islands and North-America with so many formalities, that in 1755 Martinico sent but four vessels to Canada. The direction of the colonies, now committed to the care of ignorant and avaricious clerks, soon lost its importance, sunk into contempt, and was prostituted to venality. The debts which had been contracted, during a series of calamities, had not yet been paid off, when the war broke out afresh. After a series of misfortunes and defeats, the island fell into the hands of the British. It was restored, however, in July 1763, 16 months after it had been conquered; but deprived of all the necessary means of prosperity, that had made it of so much importance. For some years past, the contraband trade carried on to the Spanish coasts was almost entirely lost. The cessation of Canada had precluded all hopes of opening again a communication, which had only been interrupted by temporary mistakes. The productions of

the Grenades, St Vincent, and Dominica, which were now become British dominions, could no longer be brought into their harbours; and a new regulation of the mother-country, which forbade her having any intercourse with Gaudalupe, left her no hopes from that quarter.

The colony, thus deprived of every thing as it were, and destitute, nevertheless contained, at the last survey, which was taken on the first of January 1770, in the compass of 28 parishes, 12,450 white people of all ages and of both sexes; 1814 free blacks or mulattoes; 70,553 slaves, and 443 fugitive negroes. The number of births in 1766, was in the proportion of one in 30 among the white people, and of one in 25 among the blacks. From this observation, if it were constant, it should seem that the climate of America is much more favourable to the propagation of the Africans than of the Europeans; since the former multiply still more in the labours and hardships of slavery, than the latter in the midst of plenty and freedom. The consequence must be, that in process of time the increase of blacks in America will surpass that of the white men; and, perhaps, at last avenge this race of victims on the descendants of the oppressors.

The cattle of the colony consists of 8283 horses or mules; 12,376 head of horned cattle; 975 hogs; and 13,544 sheep or goats.

Their provisions are, 17,930,596 trenchers of cassava; 3,509,048 banana-trees; and 406 squares and a half of yams and potatoes.

Their plantations contain 11,444 squares of land, planted with sugar; 6,638,957 coffee-trees; 871,043 cocoa-trees; 1,764,807 cotton-plants; 59,966 trees of cassia, and 61 of annatto.

The meadows or savannahs take up 10,072 squares of land; there are 11,966 in wood, and 8448 uncultivated or forsaken.

The plantations which produce coffee, cotton, cocoa, and other things of less importance, are 1515 in number. There are but 286 for sugar. They employ 116 water-mills, 12 wind-mills, and 184 turned by oxen. Before the hurricane of the 13th of August 1766, there were 302 small habitations and 15 sugar-works more.

In 1769, France imported from Martinico, upon 202 trading vessels, 177,116 quintals of fine sugar, and 12,579 quintals of raw sugar; 68,518 quintals of coffee; 11,731 quintals of cocoa; 6048 quintals of cotton; 2518 quintals of cassia; 783 casks of rum; 307 hogheads of molasses; 150 pounds of indigo; 2147 pounds of preserved fruits; 47 pounds of chocolate; 282 pounds of rasped tobacco; 494 pounds of rope-yarn; 334 chests of liquors; 234 hogheads of molasses, &c. 451 quintals of wood for dyeing; and 12,108 hides in the hair. All these productions together have been bought in the colony itself, for 536,631 l. 9s. 10d. It is true, that the colony has received from the mother-country to the amount of 588,412 l. 16s. 6d. of merchandise; but part of this has been sent away to the Spanish coasts, and another part has been conveyed to the English settlements.

The island is 16 leagues in length and 45 in circumference, leaving out the capes, some of which extend two or three leagues into the sea. It is very un-

even, and intersected in all parts by a number of hills; which are mostly of a conical form. Three mountains rise above these smaller eminences. The highest bears the indelible marks of a volcano. The woods with which it is covered continually attract the clouds, which occasions noxious damps, and contributes to make it horrid and inaccessible; while the two others are in most parts cultivated. From these mountains issue the many springs that water the island. These waters, which flow in gentle streams, are changed into torrents on the slightest storm. Their qualities are derived from the soil over which they flow. In some places they are excellent, in others so bad, that the inhabitants are obliged to drink the water they have collected during the rainy season.

Of all the French settlements in the West Indies, Martinico is the most happily situated with regard to the winds which prevail in those seas. Its harbours possess the inestimable advantage of affording a certain shelter from the hurricanes which annoy these latitudes. The harbour of Fort Royal is one of the best in all the windward islands; and so celebrated for its safety, that, when it was open to the Dutch, their shipmasters had orders from the republic to take shelter there in June, July, and August, the three months in which the hurricanes are most frequent. The lands of the Martin, which are but a league distant, are the richest and most fertile in the whole island. The numerous streams which water this fruitful country, convey loaded canoes to a considerable distance from the sea. The protection of the fortifications secured the peaceable enjoyment of so many advantages; which, however, were balanced by a swampy and unwholesome soil. This capital of Martinico was also the rendezvous of the men of war; which branch of the navy has always oppressed the merchantmen. On this account, Fort Royal was an improper place to become the centre of trade, and was therefore removed to St Peter's. This little town, notwithstanding the fires that have four times reduced it to ashes, still contains 1700 houses. It is situated on the western coast of the island, on a bay, or inlet, which is almost circular. One part of it is built on the strand along the sea side, which is called the *anchorage*; and is the place destined for ships and ware-houses. The other part of the town stands upon a low hill: it is called the *Fort* from a small fortification that was built there in 1665, to check the seditions of the inhabitants against the tyranny of monopoly; but it now serves to protect the road from foreign enemies. These two parts of the town are separated by a rivulet.

The anchorage is at the back of a pretty high and steep hill. Shut up as it were by this hill, which intercepts the easterly winds, the most constant and most salubrious in these parts; exposed, without any refreshing breezes, to the scorching beams of the sun, reflected from the hill, from the sea, and the black sand on the beach; this place is extremely hot, and always unwholesome. Besides, there is no harbour; and the ships which cannot winter safely upon this coast are obliged to take shelter at Fort-Royal. But these disadvantages are compensated by the convenience of the road of St Peter's, for loading and unloading of goods; and by its situation, which is such that ships can freely go in and out at all times, and with all winds.

MARTLETS, in heraldry, little birds represented without feet; and used as a difference or mark of distinction for younger brothers, to put them in mind that they are to trust to the wings of virtue and merit, in order to raise themselves, and not to their feet, they having little land to set their foot on. See **HERALDRY**, Plate CCXXVII. fig. 1. A.

MARTYNIA, in botany: A genus of the angiospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 16th order, *Personata*. The calyx is quinquefid, the corolla ringent, the capsule ligneous, covered with a bark, with a hooked beak, trilocular, and bivalved.—There are two species; both of them tender, herbaceous, showery plants of South America; one of them an annual, the other a perennial, rising with erect stalks, from a foot to two feet high, garnished with oblong simple leaves, and terminated by short spikes of large monopetalous, bell-shaped flowers, of blue and purple colours. They flower in July and August, and are very ornamental, but require always to be kept in the hottest part of the stove.

MARTYR, is one who lays down his life, or suffers death, for the sake of his religion. The word is Greek, *μαρτυρ*, and properly signifies “a witness.” It is applied, by way of eminence, to those who suffer in witness of the truth of the gospel.

The Christian church has abounded in martyrs, and history is filled with surprising accounts of their singular constancy and fortitude under the cruellest torments human nature was capable of suffering. The primitive Christians were accused by their enemies of paying a sort of divine worship to the martyrs. Of this we have an instance in the answer of the church of Smyrna to the suggestion of the Jews, who, at the martyrdom of Polycarp, desired the heathen judge not to suffer the Christians to carry off his body, lest they should leave their crucified master, and worship him in his stead. To which they answered, “We can neither forsake Christ, nor worship any other: for we worship him as the Son of God; but love the martyrs as the disciples and followers of the Lord, for the great affection they have shown to their King and Master.” A like answer was given at the martyrdom of Fructuosus in Spain. For when the judge asked Eulogius, his deacon, whether he would not worship Fructuosus? as thinking, that, tho’ he refused to worship the heathen idols, he might yet be inclined to worship a Christian martyr; Eulogius replied, “I do not worship Fructuosus, but him whom Fructuosus worships.” The primitive Christians believed, that the martyrs enjoyed very singular privileges; that upon their death they were immediately admitted to the beatific vision, while other souls waited for the completion of their happiness till the day of judgment; and that God would grant chiefly to their prayers the hastening of his kingdom, and shortening the times of persecution.

The churches built over the graves of the martyrs, and called by their names, in order to preserve the memory of their sufferings, were distinguished by the title *martyrium confessorio*, or *memoria*.

The festivals of the martyrs are of very ancient date in the Christian church, and may be carried back at least till the time of Polycarp, who suffered martyrdom

about the year of Christ 168. On these days the Christians met at the graves of the martyrs, and offered prayers and thanksgivings to God for the examples they had afforded them: they celebrated the eucharist, and gave alms to the poor; which, together with a panegyric oration or sermon, and reading the acts of the martyrs, were the spiritual exercises of these anniversaries.

Of the sayings, sufferings, and deaths of the martyrs, though preserved with great care, for the above purpose, and to serve as models to future ages, we have but very little left, the greatest part of them having been destroyed during that dreadful persecution which Dioclesian carried on for ten years with fresh fury against the Christians; for a most diligent search was then made after all their books and papers; and all of them that were found were committed to the flames. Eusebius, indeed, composed a martyrology, but it never reached down to us; and those since compiled are extremely suspected. From the eighth century downwards, several Greek and Latin writers endeavoured to make up the loss, by compiling, with vast labour, accounts of the lives and actions of the ancient martyrs, but which consist of little else than a series of fables: Nor are those records that pass under the name of Martyrology worthy of superior credit, since they bear the most evident marks both of ignorance and falsehood.

MARTYR (Peter), a famous divine, born at Florence in 1500. He studied philosophy and the tongues at Padua and Banomia, was a regular Augustine in the monastery of Fiesoli, and was counted one of the best preachers in Italy. Zuingleus and Bucer’s writings gave him a good opinion of the Protestants, and his conversation with Valdes confirmed it. He preached that doctrine at Rome in private; but, being impeached, fled to Naples, and thence to Lucca, where he brought over to the Protestant interest Emanuel Tremellius, Celsus, Martinengus, Paul Lascius, and Jeremias Zanchy. He was sent for to England by king Edward VI. and made professor of divinity at Oxford in 1549. In Queen Mary’s reign he returned to Strasburg, and was present at the conference of Poissy. His sentiments were not the same with Calvin’s about Christ’s presence in the eucharist. He wrote a great number of works, and died in 1562.

MARTYROLOGY, a catalogue or list of martyrs, including the history of their lives and sufferings for the sake of religion. The term comes from *μαρτυρ* “witness,” and *λογος*, or *λογος* *colloq.*

The martyrologies draw their materials from the calendars of particular churches, in which the several festivals dedicated to them are marked; and which seem to be derived from the practice of the ancient Romans, who inserted the names of heroes and great men in their fasti or public registers.

The martyrologies are very numerous, and contain many ridiculous and even contradictory narratives; which is easily accounted for, if we consider how many forged and spurious accounts of the lives of saints and martyrs appeared in the first ages of the church, which the legendary writers afterwards adopted without examining into the truth of them. However, some good critics, of late years, have gone a great way towards clearing

Martyro-
logy,
Marvell.

clearing the lives of the saints and martyrs from the monstrous heap of fiction they laboured under. See the article **LEGEND**.

The martyrology of Eusebius of Cæsarea was the most celebrated in the ancient church. It was translated into Latin by St Jerom; but the learned agree that it is not now extant. That attributed to Beda, in the eighth century, is of very doubtful authority; the names of several saints being there found who did not live till after the time of Beda. The ninth century was very fertile in martyrologies; then appeared that of Florus, subdeacon of the church at Lyons; who, however, only filled up the chafms in Beda. This was published about the year 830, and was followed by that of Waldenburtus, monk of the diocese of Treves, written in verse about the year 848, and this by that of Usuard, a French monk, and written by the command of Charles the Bald in 875, which last is the martyrology now ordinarily used in the Romish church. That of Rabanus Maurus is an improvement on Beda and Florus, written about the year 845; that of Notker, monk of St Gal, was written about the year 894. The martyrology of Ado, monk of Ferrières, in the diocese of Treves, afterwards archbishop of Vienne, is a descendant of the Roman, if we may so call it; for Du Sollier gives its genealogy thus: The martyrology of St Jerom is the great Roman martyrology; from this was made the little Roman one printed by Rofweyd; of this little Roman martyrology was formed that of Beda, augmented by Florus. Ado compiled his in the year 838. The martyrology of Nevelon, monk of Corbie, written about the year 1089, is little more than an abridgment of that of Ado; father Kircher also makes mention of a Coptic martyrology preserved by the Maronites at Rome.

We have also several protestant martyrologies, containing the sufferings of the reformed under the papists, viz. an English martyrology, by J. Fox; with others by Clark, Bray, &c.

MARTYROLOGY is also used, in the Romish church, for a toll or register kept in the vestry of each church, containing the names of all the saints and martyrs, both of the universal church and of the particular ones of that city or monastery.

MARTYROLOGY is also applied to the painted or written catalogues in the Romish churches, containing the foundations, obits, prayers, and masses, to be said each day.

MARVELL (Andrew), an ingenious writer in the 17th century, was bred at Cambridge. He travelled thro' the most polite parts of Europe, and was secretary to the embassy at Constantinople. His first appearance in public business at home was as assistant to Mr John Milton Latin secretary to the protector. A little before the restoration, he was chosen by his native town, Kingston upon Hull, to sit in that parliament, which began at Westminster April 25th 1660; and is recorded as the last member of parliament who received the wages or allowance anciently paid to representatives by their constituents. He seldom spoke in parliament, but he had great influence without doors upon the members of both houses; and prince Rupert had always the greatest regard for his advice. He made himself very obnoxious to the government by his actions and writings; notwithstanding which, king

Marvell,
Mary.

Charles II. took great delight in his conversation, and tried all means to win him over to his side, but in vain, nothing being ever able to shake his resolution. There were many instances of his firmness in resisting the offers of the court; but he was proof against all temptations. The king having one night entertained him, sent the lord-treasurer Danby the next morning to find out his lodgings; which were then up two pair of stairs in one of the little courts in the Strand. He was busy writing, when the treasurer opened the door abruptly upon him. Surprised at the sight of so unexpected a visitor, Mr Marvell told his Lordship, "That he believed he had mistaken his way." Lord Danby replied, "Not, now I have found Mr Marvell;" telling him he came from his Majesty, to know what he could do to serve him. Coming to a serious explanation, he told the lord-treasurer, that he knew the nature of courts full well; that whoever is distinguished by a prince's favour, is certainly expected to vote in his interest. The Lord Danby told him, that his Majesty had only a just sense of his merits, in regard to which he only desired to know if there was any place at court he could be pleased with. These offers, though urged with the greatest earnestness, had no effect upon him. He told the lord-treasurer, that he could not accept of them with honour; for he must be either ungrateful to the king in voting against him, or false to his country in giving into the measures of the court. The only favour therefore he had to request of his Majesty was, that he would esteem him as dutiful a subject as any he had, and more in his proper interest by refusing his offers than if he had embraced them. The Lord Danby finding no arguments could prevail, told him, that the king had ordered a thousand pounds for him, which he hoped he would receive till he could think what farther to ask of his Majesty. The last offer was rejected with the same steadfastness of mind as the first; though, as soon as the Lord-treasurer was gone, he was forced to send to a friend to borrow a guinea. He died not without strong suspicions of his being poisoned, in 1678. in the 58th year of his age. In 1688, the town of Kingston upon Hull contributed a sum of money to erect a monument over him in the church of St Giles in the Fields, where he was interred, and an epitaph composed by an able hand; but the ministry of that church forbid both the inscription and monument to be placed there. He wrote many ingenious pieces; as, The Rehearsal transposed; A short historical Essay concerning General Councils, Creeds, and Impositions in matters of religion, &c; also Poems and Letters.

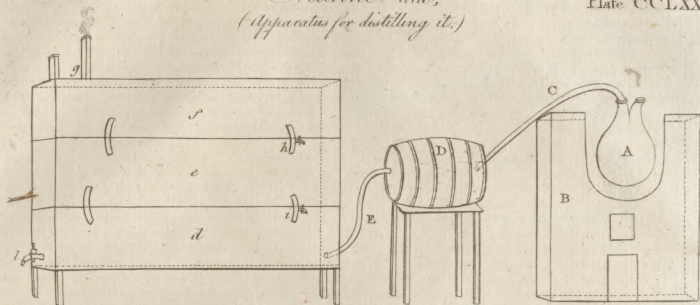
MARVEL of Peru, in botany. See **MIRABILIS**.

MARY, the mother of our Saviour Jesus Christ, and a virgin at the time that she conceived him; daughter of Joachim and of Anna, of the tribe of Judah, and married to Joseph of the same tribe. The scripture tells us nothing of her parents, not so much as their names, unless Heli mentioned by St Luke iii. 23. be the same with Joachim. All that is said concerning the birth of Mary and of her parents is only to be found in some apocryphal writings; which, however, are very ancient.

Mary was of the royal race of David, as was also her husband; "A virgin, espoused to a man whose name was Joseph, of the house of David," says our translation

*Marine. Acid,
(Apparatus for distilling it.)*

Plate CCLXXX.



MASONRY.

Fig. 1.

Fig. 2.

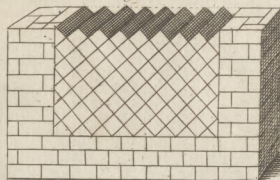
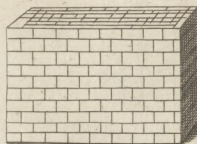


Fig. 3.

Fig. 8.

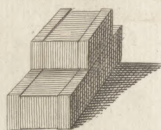


Fig. 5.



Fig. 4.

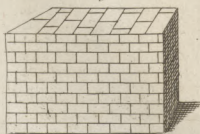


Fig. 6.

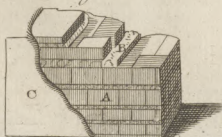
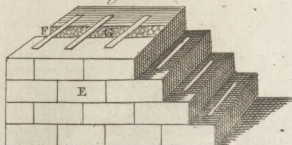
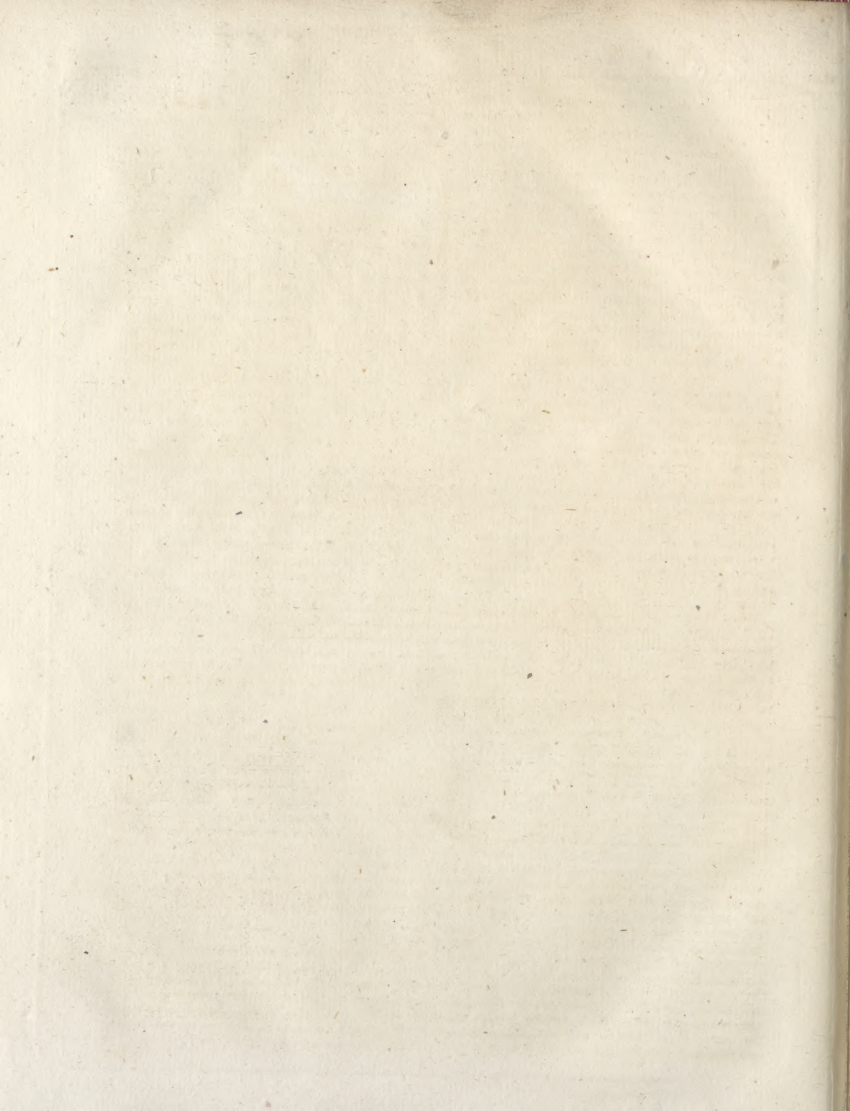


Fig. 7.



A. Bell, Drawn W. & S. Sculptor fecit.



Mary. translation of St Luke i. 27. which translation Mr Whitby thinks might be better rendered thus : 'A virgin of the house of David, espoused to a man whose name was *Joseph*, and the virgin's name was *Mary* ;' because this agrees better with the words of the angel, 'The Lord shall give him the throne of his father David,' ver. 32. For since the angel had plainly told the virgin, that she should have this son without the knowledge of any man, it was not Joseph's but Mary's being of the house of David, that made David his father.

Mary was akin to the race of Aaron, since Elizabeth the wife of Zacharias was her cousin (ver. 36). Mary very early made a vow of chastity, and engaged herself to perpetual virginity. The *Proto-evangelium* of St James tells us, that she was consecrated to the Lord, and offered in the temple from her earliest youth; and that the priests gave her Joseph for a spouse, who was an holy and venerable old man, whom providence appointed for this purpose by a miracle, the rod which he commonly carried having grown green and flourished as Aaron's did formerly. He espoused Mary, not to live with her in the ordinary use of marriage, and to have children by her, but only that he might be the guardian of her virginity. Though these circumstances are not to be relied on as certain, yet Mary's resolution of continency, even in a married state, cannot be called in question, since her virginity is attested by the gospel, and that herself speaking to the angel, who declared to her that she should become the mother of a son, told him that 'she knew not a man,' (ver. 34.), or that she lived in continency with her husband: for which reason, when Joseph perceived her pregnancy, he was extremely surprised at it, knowing the mutual resolution they had agreed to of living in continence though in a state of marriage.

When Mary was ready to lie in, an edict was published by Cæsar Augustus, which decreed, that all the subjects of the empire should go to their own cities, there to have their names registered according to their families. Thus Joseph and Mary, who were both of the lineage of David, betook themselves to the city of Bethlehem, from whence was the original of their family. But while they were in this place, the time being fulfilled in which Mary was to be delivered, she brought forth her first-born son. She wrapped him in swaddling-clothes, and laid him in the manger of the stable or cavern whither they had retired : for they could find no place in the public inn, because of the great concourse of people that were then at Bethlehem on the same occasion; or they were forced to withdraw into the stable of the inn, not being able to get a more convenient lodging because of the multitude of people then at Bethlehem.

At the same time the angels made it known to the shepherds who were in the fields near Bethlehem, and who came in the night to see Mary and Joseph and the child lying in the manger, and to pay him their tribute of adoration. Mary took notice of all these things, and laid them up in her heart, (Luke ii. 19. Matth. ii. 8, 9, 10, 11, &c.). A few days after, the magi or wise men came from the east, and brought to Jesus the mysterious presents of gold, frankincense, and myrrh; after which being warned by an angel that appeared to them in a dream, they returned into their own country by a way different from that

by which they came. But the time of Mary's purification being come, that is 40 days after the birth of Jesus, Mary went to Jerusalem (Luke ii. 21.), there to present her son in the temple, and there to offer the sacrifice appointed by the law for the purification of women after childbirth. There was then at Jerusalem an old man named *Simeon*, who was full of the Holy Ghost, and who had received a secret assurance that he should not die before he had seen Christ the Lord. He came then into the temple by the influence of the spirit of God, and taking the little Jesus within his arms, he blessed the Lord : and afterwards addressing himself to Mary, he told her, 'That this child should be for the rising and falling of many in Israel, and for a sign which should be spoken against; even so far as that her own soul should be pierced as with a sword, that the secret thoughts in the hearts of many might be discovered.' Afterwards when Joseph and Mary were preparing to return to their own country of Nazareth (Matth. ii. 13, 14.), Joseph was warned in a dream to retire into Egypt with Mary and the child, because Herod had a design to destroy Jesus. Joseph obeys the admonition, and they continued in Egypt till after the death of Herod; upon which he and Mary returned to Nazareth, not daring to go to Bethlehem because it was in the jurisdiction of Archelaus the son and successor of Herod the great. Here the holy family took up their residence, and remained till Jesus began his public ministry. We read of Mary being present at the marriage of Cana in Galilee, with her son Jesus and his disciples (John ii. 1, 2, &c.). On which occasion Jesus having turned water into wine, being the first public miracle that he performed, he went from thence to Capernaum with his mother and his brethren, or his parents and disciples : and this seems to be the place where the holy virgin afterwards chiefly resided. However, St Epiphanius thinks that she followed him every where during the whole time of his preaching; though we do not find the evangelists make any mention of her among the holy women that followed him and ministered to his necessities. The virgin Mary was at Jerusalem at the last passover that our Saviour celebrated there; she saw all that was transacted against him, followed him to Calvary, and stood at the foot of his cross with a constancy worthy of the mother of God. There Jesus seeing his mother and his beloved disciple near her, he said to his mother, "Woman, behold thy son;" and to the disciple, "Behold thy mother." And from that hour the disciple took her home to his own house. It is not to be doubted, but that our Saviour appeared to his mother immediately after his resurrection; and that she was the first, or at least one of the first, to whom he vouchsafed this great consolation. She was with the apostles at his ascension, and continued with them at Jerusalem, expecting the coming of the Holy Ghost (Acts i. 14.). After this, she dwelt in the house of St John the Evangelist, who took care of her as of his own mother. It is thought that he took her along with him to Ephesus, where she died in an extreme old age. There is a letter of the œcumenical council of Ephesus, importing, that in the fifth century it was believed she was buried there. Yet this opinion was not so universal, but that there are authors of the same age who think she died and was buried at Jerusalem.

Mary.

Mary.

MARY (Magdalen), who has been generally confounded with Mary the sister of Martha and Lazarus, but very improperly, was probably that sinner mentioned by St Luke, chap. vii. 36, 37, &c. whose name he does not tell us. There are some circumstances sufficient to convince us, that she is the same whom he calls *Mary Magdalen* in chap. viii. 2. and from whom he says Jesus drove out seven devils. Jesus having healed the widow's son of Nain, entered into the city, and there was invited to eat by a Pharisee named *Simon*. While he was at table, a woman of a scandalous life came into the house, having an alabastrer box full of perfumed oil; and standing upright behind Jesus, and at his feet, for he was lying at table on a couch after the manner of the ancients, she poured her perfume on his feet, kissed them, watered them with her tears, and wiped them with her hair. The Pharisee observing this, laid within himself, If this man were a prophet, he would know who this woman is that touches him, that she is one of a wicked life. Then Jesus, who knew the bottom of his heart, illustrated her case by a parable; and concluded with answering the woman, that her sins were forgiven her. In the following chapter, St Luke tells us, that Jesus, in company with his apostles, preached the gospel from city to city; and that there were several women whom he had delivered from evil spirits, and had cured of their infirmities, among whom was Mary called *Magdalen*, out of whom went seven devils. This, it must be owned, is no positive proof that the sinner mentioned before was Mary Magdalen; however, it is all we have in support of this opinion: An opinion which has been ably controverted by others. Mary Magdalen had her surname, it is thought, from the town of *Magdala* in Galilee. Lightfoot believes that this Mary is the same with Mary the sister of Lazarus. Magdalen is mentioned by the evangelists among the women that followed our Saviour, to minister to him according to the custom of the Jews. St Luke viii. 2. and St Mark xvi. 9. observe, that this woman had been delivered by Jesus Christ from seven devils. This some understand in the literal sense; but others take it figuratively, for the crimes and wickedness of her past life; supposing her to be the sinner first above mentioned, from which Christ had rescued her. Others maintain, that she had always lived in virginity; and consequently they make her a different person from the sinner mentioned by St Luke: and by the seven devils of which she was possessed, they understand no other than a real possession, which is not inconsistent with a holy life. This indeed is the most probable opinion, and that which has been best supported. In particular, the author of a "Letter to Jonas Hanway" on the subject of *Magdalen House*, published in 1738, has shown by a variety of learned remarks, and quotations both from the scriptures and from the best commentators, that Mary Magdalen was not the sinner spoken of by Luke, but on the contrary that she "was a woman of distinction, and very easy in her worldly circumstances. For a while, she had laboured under some bodily indisposition, which our Lord miraculously healed, and for which benefit she was ever after very thankful. So far as we know, her conduct was always regular and free from censure; and we may reasonably believe, that

after her acquaintance with our Saviour it was edifying and exemplary. I conceive of her (continues our author) as a woman of a fine understanding, and known virtue and discretion, with a dignity of behaviour becoming her age, her wisdom, and her high station; by all which, she was a credit to him whom she followed as her master and benefactor. She showed our Lord great respect in his life, at his death, and after it; and she was one of those to whom he first showed himself after his resurrection."

Mary Magdalen followed Christ in the last journey that he made from Galilee to Jerusalem, and was at the foot of the cross with the holy virgin (John xix. 25. Mark xv. 47.). After which she returned to Jerusalem to buy and prepare the perfumes, that she might embalm him after the sabbath was over which was then about to begin. All the sabbath day she remained in the city; and the next day early in the morning she went to the sepulchre, along with Mary the mother of James and Salome (Mark xvi. 1, 2; Luke xxiv. 1, 2.). On the way, they inquired of one another, who should take away the stone from the mouth of the sepulchre, and were sensible of a great earthquake. This was the token of our Saviour's resurrection. Being come to his tomb, they saw two angels, who informed them that Jesus was risen. Upon this Mary Magdalen ran immediately to Jerusalem, and acquaints the apostles with this good news, returning herself to the sepulchre. Peter and John came also, and were witnesses that the body was no longer there. They returned: but Mary stayed, and stooping forward to examine the inside of the tomb, she there saw two angels sitting, one at the head and the other at the foot of the tomb; and immediately afterwards, upon turning about, she beheld the Lord himself. She would have cast herself at his feet to kiss them. But Jesus said to her, "Touch me not, for I am not yet ascended to my Father." As if he had said, "You shall have leisure to see me hereafter; go now to my brethren, my apostles, and tell them, I am going to ascend to my God and to their God, to my Father and to their Father." Thus had Mary the happiness of first seeing our Saviour after his resurrection. (See Math. xxviii. 5, &c. Mark xvi. 6, &c. John xx. 11, 17.)

She returned then to Jerusalem, and told the apostles that she had seen the Lord, that she had spoken to him, and told them what he had said to her. But at first they did not believe her, till her report was confirmed by many other testimonies.—This is what the gospel informs us concerning Mary Magdalen, different from Mary the sister of Martha, though she has been often called by this name. For as to the pretended History of Mary Magdalen, which is said to have been written in Hebrew by Marcella servant of Martha; this can only relate to Mary sister of Martha, and besides is a mere piece of imposture.

MARY, queen and tyrant of England, was eldest daughter of Henry VIII. by his first wife Catharine of Spain, and born at Greenwich in February 1517. Her mother was very careful of her education, and provided her with tutors to teach her what was fitting. Her first preceptor was the famous Lincæus, who drew up for her use *The Rudiments of Grammar*, and afterwards *De emendata structura Latini ser-*

Mary.

Mary.

monis libri sex. Linacer dying when she was but five years old, Ludovicus Vives, a very learned man of Valenza in Spain, was her next tutor; and he composed for her *De ratione studii puerilis*. Under the direction of these excellent men, she became to great a mistress of Latin, that Erasmus commends her for her epistles in that language. Towards the end of her father's reign, at the earnest solicitation of Queen Catharine Parr, she undertook to translate Erasmus's Paraphrase on the gospel of St John; but being cast into sickness, as Udall relates, partly by overmuch study in this work, after she had made some progress therein, she left the rest to be done by Dr Mallet her chaplain. This translation is printed in the first volume of Erasmus's Paraphrase upon the New Testament, London, 1548, folio; and before it is a Preface, written by Udall, the famous master of Eton school, and addressed to the queen dowager (A).—Had she been educated in Spain, however, and an inquisitor had been her preceptor, she could not have imbibed more strongly the bloody principles of Romish persecution; and to the eternal disgrace of the English prelacy, though the reformation had taken root in both universities, the found English bishops ready to carry her cruel designs to subvert it, into effectual execution. King Edward her brother dying the 6th of July 1553, she was proclaimed queen the same month, and crowned in October by Stephen Gardiner bishop of Winchester. Upon her accession to the throne, she declared, in her speech to the council, that she would not persecute her Protestant subjects: but in the following month, she prohibited preaching without a special licence; and before the expiration of three months, the Protestant bishops were excluded the house of lords, and all the statutes

Vol. X. Part II.

of Edward VI. respecting the Protestant religion were repealed. In July 1554, she was married to Philip prince of Spain, eldest son of the emperor Charles V.; and now began that persecution against the Protestants for which her reign is so justly infamous. Some have supposed, that the queen was herself of a compassionate and humane disposition; and that most of those barbarities were transacted by her bishops without her knowledge or privy. Without her knowledge and privy they could not be: it would be a better defence of her to say, that a strict adherence to a false religion, and a conscientious observance of its pernicious and cruel dictates, over-ruled and got the better of that goodness of temper which was natural to her. But neither can this plea be reasonably admitted by any one, who considers her unkind and inhuman treatment of her sister the Lady Elizabeth; her admitting a council for the taking up and burning of her father's body; her most ungrateful and perfidious breach of promise with the Suffolk men; her ungenerous and barbarous treatment of judge Hales, who had strenuously defended her right of succession to the crown; and of Archbishop Cramer, who in reality had saved her life. Shall we excuse all this by saying, *Tantum religio potuit suadere malorum*? Her obligations to Cramer deserve to be more particularly set forth. Burnet says, "that her firm adherence to her mother's cause and interest, and her backwardness in submitting to the king her father, were thought crimes of such a nature by his majesty, that he came to a resolution to put her openly to death; and that when all others were unwilling to run any risk in saving her, Cramer alone ventured upon it. In his gentle way he told the king, "that she was young and indiscreet, and therefore it was no wonder if she obstinately adhered

Mary.

4 G

to

(A) As this preface contains many reflections which may very much edify the females of this age, we shall for their sakes here transcribe a part of it. Mr Udall takes occasion in it to observe to her majesty, "The great number of noble women at that time in England, not only given to the study of human sciences and strange tongues, but also so thoroughly expert in the Holy Scriptures, that they were able to compare with the best writers, as well in editing and penning of godly and fruitful treatises, to the instruction and edifying of realms in the knowledge of God, as also in translating good books out of Latin or Greek into English, for the use and commodity of such as are rude and ignorant of the said tongues. It was now (he said) no news in England to see young damsels in noble houses, and in the courts of princes, instead of cards and other instruments of idle trifling, to have continually in their hands either psalms, homilies, and other devout meditations, or else Paul's epistles, or some book of holy scripture matters, and as familiarly both to read or reason thereof in Greek, Latin, French, or Italian, as in English. It was now a common thing to see young virgins so trained in the study of good letters, that they willingly set all other vain pastimes at nought for learning's sake. It was now no news at all to see queens and ladies of most high estate and progeny, instead of courtly dalliance, to embrace virtuous exercises of reading and writing, and with most earnest study, both early and late, to apply themselves to the acquiring of knowledge, as well in all other liberal arts and disciplines, as also most especially of God and his holy word. And in this behalf (says he), like as to your highness, as well for composing and setting forth many godly psalms, and divers other contemplative meditations, as also for causing these paraphrases to be translated into our vulgar tongue, England can never be able to render thanks sufficient; so may it never be able, as her deserts require, enough to praise and magnify the most noble, the most virtuous, the most witty, and the most studious lady Mary's grace, for taking such pain and travail in translating this Paraphrase of Erasmus upon the gospel of St John.—What could be a more plain declaration of her most constant purpose to promote God's word, and the free grace of his gospel?" &c. Mr Udall was mistaken; she never meant any such thing: for soon after her accession to the throne, a proclamation was issued for calling in and suppressing this very book, and all others that had the least tendency towards furthering the reformation. And Mr Walpole is of opinion, that the sickness which came upon her while she was translating St John, was all affected; "for (says he) she would not so easily have been cast into sickness, had she been employed on the Legends of St Teresa or St Catharine of Sienna."

Mary.

to that which her mother and all about her had been infusing into her for many years; but that it would appear strange, if he should for this cause so far forget the father, as to proceed to extremities with his own child; that if she were separated from her mother and her people, in a little time there might be ground gained on her; but that to take away her life, would raise horror through all Europe against him;" by which means he preserved her.—Along with Archbishop Cranmer, who had thus saved her life, the bishops Ridley and Latimer were also condemned for heresy at Oxford, and afterwards burnt. In 1536, the persecution became general; and Protestants of all ranks and ages, and of both sexes, fell victims to papal fury. It is observable, likewise, that the same perfidious violation of promises and treaties prevailed in the queen's council, with respect to public affairs. By the treaty of marriage concluded between the queen and Philip, it was expressly stipulated that England should not be engaged in any wars with France on account of Spain; yet in 1557, Philip, who had brought immense sums of money into England, procured an offensive and defensive alliance against France, from the English administration, and 8000 of the queen's choicest troops were sent over to the assistance of the Spaniards in the Low Countries: the loss of Calais to the French was the first fruit of this war; and some assert, that upon this single occasion the queen showed a strong attachment to her native country, lamenting this stroke so deeply, that it occasioned her death; but it is better authenticated, that she was carried off by an epidemic fever, which raged so violently that it did not leave a sufficient number of men in health to get in the harvest. She had long, however, been a prey, if not to remorse, yet to disappointment and chagrin, arising from various cross accidents, such as want of children, and the absence and unkindness of Philip consequent thereupon. Her death happened Nov. 7. 1558, in the 43d year of her age, after a reign of five years, four months, and eleven days. There are some things of her writing still extant. Strype has preserved three prayers or meditations of hers: the first, "Against the assaults of vice;" the second, "A meditation touching adversity;" the third, "A prayer to be read at the hour of death." In Fox's "Acts and monuments" are printed eight of her letters to king Edward and the lords of the council, on her nonconformity, and on the imprisonment of her chaplain Dr Mallet. In the *Sylloge epistolarum* are several more of her letters, extremely curious: one of her delicacy in never having written but to three men; one of affection for her sister; one after the death of Anne Boleyn; and one very remarkable of Cromwell to her. In "Haynes's State Papers," are two in Spanish, to the emperor Char. V.—There is also a French letter, printed by Strype from the Cotton library, in answer to a haughty mandate from Philip, when he had a mind to marry the lady Elizabeth to the duke of Savoy, against the queen's and prince's inclination: it is written in a most abject manner, and a wretched style.

MARY of Medicis, wife of Henry IV. king of France, was declared sole regent of the kingdom in 1610, during the confection which the assassination of that beloved king had occasioned. By her ambitious in-

Mary.

trigues, the nation lost all its influence abroad, and was torn to pieces at home by contending factions. After several vicissitudes of fortune, she was abandoned by her son Louis XIII. whose reign had been constantly disturbed by the civil commotions she had occasioned; and died in indigence at Brussels, in 1642, aged 68. She built the superb palace of Luxembourg at Paris, and embellished that city with aqueducts and other ornaments.

MARY queen of Scotland, daughter of James V. was born in the royal palace of Linlithgow on the 8th of December 1542. Her mother was Mary, the eldest daughter of Claude duke of Guise, and widow of Louis duke of Longueville. Her father dying a few days after her birth, she scarcely existed before she was hailed queen.

The government of a queen was unknown in Scotland; and the government of an infant queen could not command much respect from martial and turbulent nobles, who exercised a kind of sovereignty over their own vassals; who looked upon the most warlike of their monarchs in hardly any other light than as the chief of the aristocracy; and who, upon the slightest disquits, were ever ready to fly into rebellion, and to carry their arms to the foot of the throne.—James had not even provided against the disorders of a minority, by committing to proper persons the care of his daughter's education, and the administration of affairs in her name. The former of these objects, however, was not neglected, though the regency of the kingdom was entrusted to very feeble hands. At six years of age Mary was conveyed to France, where she received her education in the court of Henry II. The opening powers of her mind, and her natural dispositions, afforded early hopes of capacity and merit. After being taught to work with her needle and in tapestry, she was instructed in the Latin tongue; and she is said to have understood it with an accuracy, which is in this age very uncommon in persons of her sex and elevated rank, but which was not then surprising, when it was the fashion among great ladies to study the ancient languages. In the French, the Italian, and the Spanish tongues, her proficiency was still greater, and she spoke them with equal ease and propriety. She walked, danced, and rode with enchanting gracefulness; and she was qualified by nature, as well as by art, to attain to distinction in painting, poetry, and music. To accomplish the woman was not, however, the sole object of her education. Either she was taught, or she very early discovered, the necessity of acquiring such branches of knowledge as might enable her to discharge with dignity and prudence the duties of a sovereign; and much of her time was devoted to the study of history, in which she delighted to the end of her life.

Whilst Mary resided in the court of Henry II. her personal charms made a deep impression on the mind of the Dauphin. It was in vain that the constable Montmorency opposed their marriage with all his influence. The importance of her kingdom to France, and the power of her uncles the princes of Lorraine, were more than sufficient to counteract his intrigues; and the Dauphin obtained the most beautiful princess in Christendom.

Though this alliance placed the queen of Scotland,

Mary. in the most conspicuous point of view, in the politest court of Europe, and drew to her those attentions which are in the highest degree pleasing to a female mind in the gaiety of youth; it may yet be considered as having accidentally laid the foundation of the greatest part of her future misfortunes. Elizabeth, who now swayed the sceptre of England, had been declared illegitimate by an act of parliament: and though the English Protestants paid no regard to a declaration which was compelled by the tyrannic violence of Henry VIII. and which he himself had indeed rendered null by calling his daughter to the throne after her brother and elder sister; yet the papists both at home and abroad had objections to the legitimacy of Elizabeth's birth, founded on principles which with them had greater weight than the acts of any human legislature. Mary was unquestionably the next heir in regular succession to the English throne, if Elizabeth should die without legitimate issue; and upon her marriage to the Dauphin, she was induced by the persuasion of her uncles, by the authority of the French king, and no doubt partly by her own ambition, to assume the title and arms of queen of England and Ireland. These, indeed, she forebore as soon as she became her own mistress; but the having at all assumed them was an offence which Elizabeth could never forgive, and which ranking in her bosom made her many years afterwards pursue the unhappy queen of Scots to the block.

Henry II. dying soon after the marriage of the Dauphin and Mary, they mounted the throne of France. In that elevated station, the queen did not fail to distinguish herself. The weakness of her husband served to exhibit her accomplishments to the greatest advantage; and in a court where gallantry to the sex, and the most profound respect for the person of the sovereign, were inseparable from the manners of a gentleman, she learned the first lessons of royalty. But this scene of successful grandeur and unmixed felicity was of short duration. Her husband Francis died unexpectedly, after a short reign of sixteen months. Regret for his death, her own humiliation, the disgrace of her uncles the princes of Lorraine, which instantly followed, and the coldness of Catharine of Medicis the queen mother, who governed her son Charles IX. plunged Mary into inexpressible sorrow. She was invited to return to her own kingdom, and she tried to reconcile herself to her fate.

She was now to pass from a situation of elegance and splendour to the very reign of incivility and turbulence, where most of her accomplishments would be utterly lost. Among the Scots of that period, elegance of taste was little known. The generality of them were sunk in ignorance and barbarism; and what they termed religion, dictated to all a petulant rudeness of speech and conduct, to which the queen of France was wholly unaccustomed. During her minority and absence, the Protestant religion had gained a kind of establishment in Scotland; obtained, indeed, by violence, and therefore liable to be overturned by an act of the sovereign and the three estates in parliament. The queen, too, was unhappily of a different opinion from the great body of her subjects, upon that one topic, which among them actuated almost every heart, and directed almost every tongue. She had been educated

in the church of Rome, and was strongly attached to that superstition: Yet she had either moderation enough in her spirit, or discretion enough in her understanding, not to attempt any innovation in the prevailing faith of protestantism. She allowed her subjects the full and free exercise of their new religion, and only challenged the same indulgence for her own. She contrived to attach to her, whether from his heart or only in appearance, her natural brother, the prior of St Andrew's; a man of strong and vigorous parts, who, though he had taken the usual oath of obedience to the Pope, had thrown off his spiritual allegiance, and placed himself at the head of the reformers. By his means she crushed an early and formidable rebellion; and in reward for his services conferred upon him a large estate, and created him Earl of Murray. For two or three years her reign was prosperous, and her administration applauded by all her subjects, except the Protestant preachers; and had she either remained unmarried, or bestowed her affections upon a more worthy object, it is probable that her name would have defended to posterity among those of the most fortunate and the most deserving of Scottish monarchs.

But a queen, young, beautiful, and accomplished, an ancient and hereditary kingdom, and the expectation of a mighty inheritance, were objects to excite the love and ambition of the most illustrious personages. Mary, however, who kept her eye steadily fixed on the English succession, rejected every offer of a foreign alliance; and, swayed at first by prudential motives, and afterwards by love the most excessive, she gave her hand to Henry Stuart, lord Darnley, the son of the earl of Lenox. This nobleman was, after herself, the nearest heir to the crown of England; he was likewise the first in succession after the earl of Arran to the crown of Scotland; and it is known that James V. had intended to introduce into his kingdom the Salique law, and to settle the crown upon Lenox in preference to his own daughter. These considerations made Mary solicitous for an interview with Darnley; and at that interview love stole into her heart, and effaced every favourable thought of all her other suitors. Nature had indeed been lavish to him of her kindness. He was tall of stature; his countenance and shapes were beautiful and regular; and, amidst the masks and dancing with which his arrival was celebrated, he shone with uncommon lustre. But the bounty of nature extended not to his mind. His understanding was narrow; his ambition excessive; his obstinacy inflexible; and under the guidance of no fixed principle, he was inconstant and capricious. He knew neither how to enjoy his prosperity nor how to ensure it.

On the 29th of July 1565, this ill-fated pair were married; and though the queen gave her husband every possible evidence of the most extravagant love; though she infringed the principles of the constitution to confer upon him the title of king; and though she was willing to share with him all the offices, honours, and dignities of royalty—he was not satisfied with his lot, but soon began to clamour for more power. He had not been married seven months, when he entered into a conspiracy to deprive Mary of the government, and to seat himself on her throne. With this view he

Mary.

headed a band of factious nobles, who entered her chamber at night; and though she was then far advanced in her pregnancy, murdered her secretary in her presence, whilst one of the ruffians held a cocked pistol to her breast. Such an outrage, together with his infidelity and frequent amours, could not fail to alienate the affections of a high spirited woman, and to open her eyes to those defects in his character which the ardors of love had hitherto prevented her from seeing. She sighed and wept over the precipitation of her marriage: but though it was no longer possible to love him, she still treated him with attention and respect, and laboured to fashion him to the humour of her people.

This was labour in vain. His preposterous vanity and aspiring pride roused the resentment and the scorn of the nobles: his follies and want of dignity made him little with the people. He deserted the conspirators with whom he had been leagued in the assassination of the secretary; and he had the extreme imprudence to threaten publicly the earl of Murray, who, from his talents and his followers, possessed the greatest power of any man in the kingdom. The consequence was, that a combination was formed for the king's destruction; and, on the 10th day of February 1567, the house in which he then resided was early in the morning blown up with gun-powder, and his dead and naked body, without any marks of violence, was found in an adjoining field.

Such a daring and atrocious murder filled every mind with horror and astonishment. The queen, who had been in some measure reconciled to her husband, was overwhelmed with grief, and took every method in her power to discover the regicides; but for some days nothing appeared which could lead to the discovery. Papers indeed were posted on the most conspicuous places in Edinburgh, accusing the earl of Bothwell of the crime; and rumours were indoltriously circulated that his horrid enterprise was encouraged by the queen. Conscious, it is to be presumed, of her own innocence, Mary was the less disposed to believe the guilt of Bothwell, who was accused as having only acted as her instrument; but when he was charged with the murder by the earl of Lenox, she instantly ordered him on his trial. Through the management of the earl of Morton and others, who were afterwards discovered to have been partners in his guilt, Bothwell was acquitted of all share and knowledge of the king's murder; and what is absolutely astonishing, and shows the total want of honour at that time in Scotland, this flagitious man procured, by means of the same treacherous friends, a paper signed by the majority of the nobles, recommending him as a fit husband for the queen!

Armed with this instrument of mischief, which he weakly thought sufficient to defend him from danger, Bothwell soon afterwards seized the person of his sovereign, and carried her a prisoner to his castle at Dunbar. It has indeed been alleged by the enemies of the queen, that no force was employed on the occa-

Mary.

sion; that she was seized with her own consent; and that she was even privy to the subscribing of the bond by the nobles. But it has been well observed by one of her ablest vindicators (A), that "her previous knowledge of the bond, and her acquiescence in the seizure of her person, are two facts in apparent opposition to each other. Had the queen acted in concert with Bothwell in obtaining the bond from the nobles, nothing remained but, under the sanction of their unanimous address, to have proceeded directly to the marriage. Instead of which, can we suppose her so weak as to reject that address, and rather *choose* that Bothwell should attempt to seize and carry her off by violence?—an attempt which many accidents might frustrate, and which at all events could not fail to render him or both of them odious to the whole nation. Common sense, then, as well as candour, must induce us to believe, that the scheme of seizing the queen was solely the contrivance of Bothwell and his associates, and that it was really by force that she was carried to Dunbar." Being there kept a close prisoner for 12 days; having, as there is reason to believe, actually suffered the indignity of a rape; perceiving no appearance of a rescue; and being shown the infamous bond of the nobles; Mary promised to receive her ravisher for a husband, as in her opinion the only refuge for her injured honour. Without condemning with asperity this compliance of the queen, it is impossible not to recollect the more dignified conduct which Richardson attributes in similar circumstances to his Clarissa; and every man who feels for the sufferings, and respects the memory of Mary, must regret that she had not fortitude to resist every attempt to force upon her as a husband the profligate and audacious villain who had offered her such an insult as no virtuous woman ought ever to forgive. This, however, is only to regret that she was not more than human; that she who possessed so many perfections, should have had them blended with one defect. "In the irretrievable situation of her affairs, let the most severe of her sex say what course was left for her to follow? Her first and most urgent concern was to regain her liberty. That probably she attained by promising to be directed by the advice of her council, where Bothwell had nothing to fear." The marriage, thus inauspiciously contracted, was solemnized on the 15th of May 1567; and it was the signal for revolt to Morton, Lethington, and many of the other nobles, by whose wicked and relentless policy it had been chiefly brought about, and who had bound themselves to employ their swords against all persons who should presume to disturb so desirable an event.

As Bothwell was justly and universally detested, and as the rebels pretended that it was only against him and not against their sovereign that they had taken up arms, troops flocked to them from every quarter. The progress and issue of this rebellion will be seen in our history of SCOTLAND: suffice it to say here, that upon the faith of promises the most solemn, not only of personal safety to herself, but of receiving

(A) *Tytler's Dissertation on the Marriage of Queen Mary with the Earl of Bothwell*: Transactions of the Society of Antiquaries of Scotland, Vol. I.

Mary.

as much honour, service, and obedience, as ever in any former period was paid by the nobility to the princes her predecessors, the unhappy queen delivered herself into the hands of her rebels, and persuaded her husband to fly from the danger which in her apprehension threatened his life. These promises were instantly violated. The faithless nobles, after insulting their sovereign in the cruellest manner, hurried her as a prisoner to a castle within a lake, where she was committed to the care of that very woman who was the mother of her bastard brother; who, with the natural insolence of a whore's meanness, says Mr Whitaker, asserted the legitimacy of her own child and the illegitimacy of Mary; and who actually carried the natural vulgarity of a whore's impudence so far, as to strip her of all her royal ornaments, and to dress her like a mere child of fortune in a coarse brown calico.

In this distress the queen's fortune and presence of mind did not forsake her: She contrived to make her escape from her prison, and soon found herself at the head of 6000 combatants. This army, however, was defeated; and, in opposition to the advice and intreaties of all her friends, she hastily formed the resolution of taking *refuge in England*. The archbishop of St Andrew's in particular accompanied her to the border; and when she was about to quit her own kingdom, he laid hold of her horse's bridle, and on his knees conjured her to return: but Mary proceeded, with the utmost reliance on the friendship of Elizabeth, which had been offered to her when she was a prisoner, and of the sincerity of which the harboured not a doubt.

That princess, however, who had not yet forgotten her assumption of the title and arms of queen of England, was now taught to dread her talents and to be envious of her charms. She therefore, under various pretences, and in violation not only of public faith, but even of the common rights of hospitality, kept her a close prisoner for 19 years; encouraged her rebellious subjects to accuse her publicly of the murder of her husband; allowed her no opportunity of vindicating her honour; and even employed venal scribblers to blast her fame. Under this unparalleled load of complicated distress, Mary preserved the magnanimity of a queen, and practised with sincerity the duties of a Christian. Her sufferings, her dignified affability, and her gentleness of disposition, gained her great popularity in England, especially among the Roman Catholics; and as she made many attempts to procure her liberty, and carried on a constant correspondence with foreign powers, Elizabeth became at last so much afraid of her intrigues, that she determined to cut her off, at whatever hazard. With this view she prevailed upon her servile parliament to pass an act which might make Mary answerable for the crimes of all who should call themselves her partizans; and upon that flagitious statute she was tried as a traitor concerned in the conspiracy of Babington: (see SCOTLAND). Though the trial was conducted in a manner which would have been illegal even if she had been a subject of England, and though no certain proof appeared of her connection with the conspirators, she was, to the amazement of Europe, condemned to suffer death.

The fair heroine received her sentence with great

composure; saying to those by whom it was announced, "The news you bring cannot but be most welcome, since they announce the termination of my miseries. Nor do I account that foul to be deservful of the felicities of immortality which can shrink under the sufferings of the body, or scruple the stroke that sets it free." On the evening before her execution, for which, on the succeeding morn, she prepared herself with religious solemnity and perfect resignation, she ordered all her servants to appear before her, and drank to them. She even condescended to beg their pardon for her omissions or neglects; and she recommended it to them to love charity, to avoid the unhappy passions of hatred and malice, and to preserve themselves steadfast in the faith of Christ. She then distributed among them her money, her jewels, and her clothes, according to their rank or merit. She wrote her will with her own hand, constituting the duke of Guise her principal executor; and to the king and queen of France she recommended her son, provided he should prove worthy of their esteem.—In the castle of Fotheringay she was beheaded on the 8th of February 1587, in the 45th year of her age; and her body, after being embalmed and committed to a leaden coffin, was buried with royal pomp and splendor in the cathedral of Peterborough. Twenty years afterwards her bones were by order of her son and only child King James I. removed to Westminster, and deposited in their proper place among the kings of England.

The general character of Mary, which in the regular order of biography should now be laid before the reader, has furnished matter of controversy for 200 years. She is universally allowed to have had considerable talents, and a mind highly cultivated. By one party she is painted with more virtues and with fewer defects than almost any other woman of the age in which she lived. By another she is represented as guilty of the grossest crimes which a woman can commit—adultery and the murder of her husband. By all it is confessed, that, previous to her connection with the earl of Bothwell, her life as a Christian was exemplary, and her administration as a queen equitable and mild; and it has never been denied that she bore her tedious sufferings with such resignation and fortitude as are seldom found united with conscious guilt. These are strong presumptions of her innocence. The moral characters of men change by degrees; and it seems hardly consistent with the known principles of human nature, that any person should at once plunge deliberately from the summit of virtue to the depths of vice; or, when sunk so low, should by one effort recover his original state of elevation. But in this controversy presumptions must go for nothing. The positive evidences which were brought against the queen of Scots are so conclusive, that if they be genuine the guilt have been guilty; and if they be spurious, there can be no doubt of her innocence. They consisted of a box with letters, contracts, and sonnets, said to be written by herself and sent to the earl of Bothwell. In addition to these, the supposed confessions of the criminals who had suffered for the king's murder were originally urged as proofs of her guilt: but those confessions are now admitted by all parties to be either wholly forged, or so grossly interpolated that no fires whatever can be laid upon them; and during Mary's life it was as-
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firmed by her friends, and not sufficiently contradicted by her enemies, that the persons who had accused Bothwell, and were doubtless his accomplices, instead of criminating the queen, had openly protested her innocence in their dying moments.

Stuart's History of Scotland.

This box then, with its contents, was the evidence upon which her accusers had the chief and indeed the only reliance; and it is upon this evidence, whatever it be, that the guilt or innocence of the Scottish princes must finally be determined. It is uniformly affirmed upon the part of the earl of Murray and his faction, that the casket with the letters and the sonnets had been left by Bothwell in the castle of Edinburgh; that this nobleman, before he fled from Scotland, sent a messenger to recover them; and that they were found in the possession of this person. The 20th day of June 1567 is fixed as the date of this remarkable discovery. The governor of the castle at that time was Sir James Balfour. George Dalgleish, a servant of Bothwell's, is named as his messenger upon this errand. He was seized, it is said, by the domestics of the earl of Morton; and it was the earl of Morton himself who made the actual production of the casket and its contents.

This story is unsupported by vouchers, contains improbabilities, and cannot be reconciled with history and events. There remains not any authentic or unsuspicious evidence that the queen had dishonoured the bed of Lord Darnley; and there is the most satisfactory evidence†, that though Bothwell was entrusted with the defence of the borders on account of his tried courage and loyalty, he was privately disliked by Mary for his uncommon zeal in the cause of Protestantism. At the very time when the queen is said to have had the most violent love for that nobleman, and with him to have been carrying on the most criminal intercourse against her husband, we know both from Randolph and from Knox, that Bothwell refused to gratify her by the smallest compliance with the ceremonies of her religion, though many of the other Protestant peers scrupled not to accompany her to the celebration of the mass. That the villain who could deliberately commit murder, should be so scrupulously conscientious with respect to modes of faith and worship, as to stand forward with a *peculiar* strain of bravery to oppose, in a favourite measure, the queen, who was then admitting him to her bed, and actually forming plans for raising him to her throne, is surely, to say the least of it, extremely improbable.

But let us suppose this non-compliance on the part of Bothwell to have been a measure concerted between the queen and him to conceal more effectually from the eyes of the public the criminal intercourse in which they were engaged; is it not very surprising, that of such politicians, the *one* should have written those letters, and the *other* have left them in the power of their enemies? The earl of Bothwell was exposed to more than suspicions of a concern in the murder of the king. These papers contained manifest proofs of his guilt. It evidently was not his interest to preserve them: or admitting, that till his marriage was solemnized with the queen he might look upon them as his best security for the realising of his ambitious hopes, yet, after that event, when all his former friends had deserted him, he must have felt the strongest inducements to destroy such a criminal correspon-

dence; and Mary must have been ardently animated with the same wish. The castle of Edinburgh, where the box is said to have been lodged, was at this time entirely at their command; and Sir James Balfour, their deputy, was the creature of Bothwell. If his enemies, who were now in arms against him, should possess themselves of this box and its contents, his destruction was inevitable. From his marriage till the 5th day of June, it was in his power to have destroyed the fatal papers; and if they had existed, it is not to be imagined that he would have neglected a step so expedient, not only for his own security and reputation, but also for those of the queen. During all this time, however, he made no effort to recover his box and letters: he had lodged them in the castle of Edinburgh; and there he chose to leave them in the custody of a man in whom he could not have one particle of reliance. This was exceedingly foolish; but his subsequent conduct was still more so. Upon the 6th day of June, it is evident that he had reason to suspect the fidelity of Sir James Balfour, since he avoided to take refuge in the castle of Edinburgh and fled to Dunbar. He returned, however, with an army in order to fight the rebels. The balance of empire might then seem to hang suspended between himself and his enemies; and in that state of things, a man of such commodious principles as Balfour appears to have been, might be inclined to do his old friend and patron a secret service, both to efface his former perfidy and to create himself a new interest with him in case he should be victorious over the rebels. Yet in these critical moments Bothwell neglected to make any application to him for the casket and the letters! On the 15th of June, all his towering imaginations were at once dashed to the ground. He had come to Carberry-hill, followed by an army and accompanied by a queen; but he fled from it attended only by a single servant, and was glad to shelter himself in the castle of Dunbar from the vengeance due to his crimes. Yet in this extremity of distress he is represented as trying a bold experiment, which he had not courage to try when he was fortified with the authority of his sovereign, and when he was facing the rebels in the field. In the very hour when almost every friend had deserted him, he expected a return of friendship from a man who had deserted him at first only because he *suspected him to be in danger*. At this period he sent his servant George Dalgleish to wait upon Balfour, the acting governor of the castle of Edinburgh, with a requisition for the box of letters, and to bring back the important charge, through ten thousand dangers, to Dunbar. Though this man was one of his agents in the murder of the king, and might therefore have been safely entrusted with any secret, he did not order him, as common sense requires he should have done, to destroy the letters as soon as he should get them into his possession. No! he sent him to fetch them from the castle, as if there was no danger in going thither, no doubt of receiving them there, and no difficulty in carrying them back. † To †

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† Whitaker's Vindication.

† Whitaker's Vindication.

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Mary. his master, finds his way to the castle, and delivers his message. But what is more astonishing than all, he actually receives the box of letters from Sir James Balfour. This indeed, says Mr Whitaker, is "o'er-doing Termagant; it out-herods Herod." Balfour was the ductile slave of selfishness. He had with infinite perfidiousness turned against his friend, his patron, and his queen, only because he saw them opposed by a party which he *thought* would prove too strong for them; but now when they were both plunged into the lowest state of distress, and branded with the appellation of regicides, his selfishness was suddenly changed into generosity, his meanness gave place to exalted sentiments, and, at the peril of his own life, he performed an heroic act of kindness! "In such circumstances (asks a contemporary writer), is it to be thought, either that the earl would send to the said Sir James, or that the said Sir James would send any thing to the earl? Is it likely? Is it credible?" No matter: Bothwell is made to send for his papers at a time when his difficulties and his despair render it *improbable* that he could *think* of them, and when it was absolutely *impossible* that he could *recover* them. His messenger accordingly is intercepted with the casket; and the adversaries of the queen, upon the 20th day of June, became possessed of vouchers with which they might operate her destruction. These inconsistencies are glaring, and of a force not easily to be controverted; and the story is open to other objections, which are, if possible, greater, and altogether insurmountable.

By comparing different proclamations of the rebels with the several dispatches of Throgmorton, who was then Elizabeth's resident in Scotland, Mr Whitaker has made it appear in the highest degree probable, that Dalgleish was *not seized till* the 17th of July; that he was then, in consequence of an order issued by the court of session, apprehended, together with Powrie, another of Bothwell's servants, in that nobleman's lodgings in the palace of Holyroodhouse; and that therefore he could not be the bearer of the letters intercepted by the earl of Morton on the 20th of June. What adds greatly to this probability is the account which the rebels themselves give of his examination. A few days after he was taken, he was examined, *say* they, judicially, in a council where the earls of Morton and Athol are marked as present. It was natural upon this occasion to make inquiries about the casket and the papers. No questions, however, were put to him on that subject. He was not confronted with Sir James Balfour, from whom he had received the casket; nor with the domestics of the earl of Morton, by whom it was said that he had been apprehended. He was kept in prison many months after this examination; and during a period when the rebels were infinitely pressed to apologize for their violence against the queen, there were opportunities without number of bringing him to a confession. These opportunities, however, were avoided; and there exists not the slightest evidence that the casket and the papers had ever been in his possession. Is it then to be supposed, that if the casket and the papers had really been discovered with *him*, the establishment of a fact so important would have been neglected by the adversaries of the queen? No! they would have established

it by the most complete evidence; which they were so far from attempting to do, that the earliest account which they give of their pretended seizure of the letters is dated *fifteen months* after the event itself, and nearly *nine months* after the death of Dalgleish. To have blazoned their discovery at the time they pretend it was made, might have been attended with very disagreeable consequences; for Dalgleish, who at his execution asserted the innocence of the queen, and actually charged the earls of Murray and Morton as the contrivers of the murder, might have found proof that the casket could not possibly have been intercepted in his custody.

The 20th of June 1567 is fixed as the æra of the discovery of the letters. If this discovery had been real, the triumph of the enemies of the queen would have been infinite. They would not have delayed one moment to proclaim their joy, and to reveal to her indignant subjects the fulness and the infamy of her guilt. They preserved, however, a long and a profound silence. It was not till the 4th of December 1567 that the papers received their first mark of notice or distinction; nor till the 16th of September 1568, that the earl of Morton was said to have intercepted them with Dalgleish. From the 20th day of June to the 4th day of December, many transactions and events of the highest importance had taken place; and the most powerful motives that have influence with men had called upon them to publish their discovery. They yet made no production of the papers, and ventured not to appeal to them. In the proclamation which they issued for apprehending Bothwell, they inveigh against his guilt, and express an anxious desire to punish the regicides; yet though this deed was posterior to the 20th of June, there is no assertion in it to the dishonour of the queen; and it contains no mention of the box and the letters. An ambassador arrived in this interval from France, to inquire into the rebellion and the imprisonment of the queen; yet they apologized not for their conduct by communicating to him the contents of the casket. To Throgmorton, who had instructions to act with Mary as well as with her adversaries, they denied the liberty of waiting upon her at Lochleven, where she was detained a close prisoner; and they were earnest to impress him with the idea that her love of Bothwell was incurable. He pressed them on the subject of their behaviour to her. At different times they attempted formally to vindicate themselves; and they were uniformly vehement on the topic of the love which she bore to that nobleman. Yet they abstained from producing the letters to him. "They even spoke of her to him with *respect* and *reverence*;" which surely they could not possibly have done had they been then in possession of the letters. They were solicitous to divide the faction of the nobles who adhered to the queen; and there could not have been a measure so effectual for this end as the production of the casket and its contents; yet they called no convention of her friends, to surprise and disunite them with this fatal discovery. They flattered the Protestant clergy, attended assemblies of the church, instilled into them a belief of the queen's being guilty of murder and adultery, and incited Mr Knox to "inveigh against her vehemently in his sermons, to persuade ex-

Mary.

tremities towards her, and (as Throgmorton continues) to threaten the great plague of God against the whole country and nation if she should be spared from her *condign punishment* ;” but they ventured not to excite the fury of these ghastly fathers by exhibiting to them the box and the letters. They compelled the queen to subscribe a renunciation of her crown ; and they had the strongest reason to be solicitous to justify this daring transaction. The box and the letters would have served as a complete vindication of them : yet they neglected to take any notice of these important vouchers ; and were contented with resting on the wild and frivolous pretence that the queen, from sickness and fatigue, was disgusted with the care of her kingdom.

To the irrefragable proof of the forgery of the letters arising from their having been so long concealed, it has been replied, that the rebels could not produce them sooner with any regard to their own safety. “† A considerable number of their fellow-subjects, headed by some of the most powerful noblemen in the kingdom, was combined against them. This combination they could not hope to break or to vanquish without aid either from France or England. In the former kingdom, Mary’s uncles, the duke of Guise and the cardinal of Lorraine, were at that period all-powerful, and the king himself was devotedly attached to her. The leading the queen, therefore, with the imputation of being accessory to the murder of her husband, would be deemed such an inexpiable crime by the court of France, as must cut off every hope of countenance or aid from that quarter. From England, with which the principal confederates had been long and intimately connected, they had many reasons to expect more effectual support ; but, to their astonishment, Elizabeth condemned their proceedings with asperity. Her high notions of royal authority, and of the submission due by subjects, induced her on this occasion to exert herself in behalf of Mary, not only with sincerity but with zeal : she negotiated, she solicited, she threatened. From all these circumstances, the confederates had every reason to apprehend that Mary would soon obtain her liberty, and by some accommodation be restored to the whole, or at least to a considerable portion, of her authority as sovereign ; and therefore they were afraid of the consequences of accusing her publicly of crimes so atrocious as adultery and murder.”

This apology for the rebels consists of assertions for which there is no evidence, and of arguments which are wholly untenable. There is no evidence that Elizabeth exerted herself in behalf of Mary with sincerity and with zeal. If she had, she would have done more than threaten. An English army of 3000 men, aided by the Scottish combination which continued faithful to the queen, would have overturned the rebel government in the space of a month. It is inconceivable that the rebels were prevented by any apprehension of the queen’s restoration from accusing her of the crimes of murder and adultery ; for we learn from a dispatch of Throgmorton’s dated the 19th of July 1567, that “men of good regard did then boldly and overtly by their speech, utter great rigour and extremity against their sovereign ; saying, it shall not be in the power of any *within* this realm, neither *without*, to keep her from condign pu-

N^o 196.

nishment for her notorious crimes.” From another dispatch of the same ambassador’s, dated five days after the former, we learn, that through him *actually* did accuse her to Elizabeth of “incontinency ; as well with the earl of Bothwell as with others, and likewise of the murder of her husband, of which, they said, they had as apparent proof against her as might be ; as well by the testimony of *her own hand-writing*, which they had recovered, as also by sufficient witnesses.” This testimony, however, was not produced till more than four months afterwards ; a certain proof, that though it was now in the hands of the manufacturers, it was not yet ready for inspection.

But let us take the facts of this ablest antagonist of Mary as he has stated them, and consider the argument which they are made to support. It is apparent, from the last quoted dispatch of Throgmorton †, that it could not be known, either to the court of France or the court of England, that the rebels were at all events determined to crown the prince, and either to put the queen to death or to keep her a close prisoner for life. These desperate enterprises, however, could not, it seems, be carried into effect without the countenance and aid of Elizabeth or Charles : but Elizabeth’s notions of regal authority, and of the submission due by subjects, were high ; and the French king was devotedly attached to the dethroned queen. If this was so, common sense says, that the business of the confederates, since they expected aid from these princes, was to charge Mary at once with the murder and adultery, and support the charge with the most convincing evidence which they had to produce. No ! says this apologist of theirs, Charles IX. would have considered such conduct as a crime inexpiable, though he might *reasonably* be expected to give them his countenance in putting to death, or keeping in perpetual prison, for a comparatively venial offence, the queen to whom he was devotedly attached ! This is strange reasoning ; but it seems not to have occurred to the rebels themselves. The letters made their first appearance in a secret council assembled by the earl of Murray on the 4th of December 1567 ; and the reason there assigned by the confederates for their unwillingness to produce them was, “That lust they bear unto his person, wha sometime was their sovereigne, and for the reverence of his majestie, whais moder the is, as alwa they mny gude and excellent gifts and vertues quherewith God sometimes indowit hir.” And they proceed to say, that they would not have produced them at all, “gis otherwise the sinceritie of their intentions and proceedings from the beginning myht be known to forein nacions and the inhabitants of this ile (of whome many yet remains in suspence in judgment) satisfeit and resolvit of the richtheis of their quarrel, and the securitie of them and thaire posteritie be any other meane might be providit and established.” So far were they from dreaming that the production of the letters would injure their cause in the court of France, that we see they frankly acknowledged that the sincerity and rectitude of their proceedings could not otherwise be manifested to foreign nations. In this instance they think and talk like reasonable men ; but they do not long preserve the same consistency.

In this act of council the rebels discover the greatest anxiety for their pardon and security : And “the matter

Mary.

† Whitaker.

‡ Robertson’s
Dissertation,
2dth edit.

Mary.

mattier being largelie and with gude deliberacion ressonit at great length, and upon fundry daies; at last all the said lords, barrones, and others above ex- premit, can find no other way or moeyen how to find or make the said securitie but be oppynynge and reveling of the truth and *grund of the bail matter frae the be- ginnings*, plainlie and uprightlie, &c. Therefore the lords of fecrete council, &c. desires it to be found and declarit be the estates and hail body of the parlia- ment, that the cause and occasion of the tacking of the queen's persoun upon the 15th daie of Junii last by past, and holding and detaininge of the same within the hous and place of Lochlevin continewallie fensyne, presentlie, and in all tymes comyng; and generally all other things *inventit*, spokin, writtin, or donne be them, or onny of them, sen the tent daie of February last by past unto the daie and date *heirsof*, towiching the said queen hir persoun: that caus, and all things depending theirown, or that onie wife maid appertene theirown, &c. was in the said queen's awin default, in as far as be DIVERS HIR PRIVIE LETTERS WRITTEN AND SUBSCRIVIT WITH HIR AWIN HAND, and sent by her to James Erll Bothwell, &c.—and be her ungodlie and dishonourable proceedinge in a privait mar- riage, foddanlie and unprovifitly, it is most certain, that she was previe, art and part, and of the actual devise and deid of the for-mencionit murder of the kinge, her lawchfull husband, our soveraine lorde's father, committit be the said James Erll Bothwell, &c."

Had the letters been really genuine, into the ab- surdity of this declaration no man of common sense could possibly have fallen. Truth is always consistent with itself; but in a series of forgeries contradictions are scarcely avoidable. The confederates rose in rebellion against the queen on the 10th of June; they faced her in rebellion at Carberry-hill on the 15th; they sent her away into prison on the 16th: yet they afterwards justified *all* that they had done since the *tenth of February* by letters, which, they *said*, they had not till the *twentieth of June*! "This (says Mr Whitaker), if we consider it as folly, is one of the most striking and eminent acts of folly that the world has ever beheld. But it ought to be considered in a light much more dishonourable to the rebels; and as knavery, it is one of the rankest that has ever been attempted to be imposed upon the sons of men." On the 4th of December, it must be remembered that they had not fixed *any day* for the discovery of the letters. The story of the seizure of Dalgleish with the casket was not thought of till near a year afterwards; and when it was invent- ed, they had certainly forgotten the date of their act of council. In that act, therefore, they were free to rove at large; but they roved very incautiously. By grounding upon the letters, proceedings prior to the 10th of June, they plainly declare the discovery of these fatal papers to have been *antecedent to the twentieth*. By grounding upon them their secret messages for sedition, their private conventions for rebellion, and "every thing *inventit*, spokin, written, or done be them, or any of them, respecting the queen, Both- well, or Darnley, sen the *tent daie of February* last by past," they even intimate the discovery to have been previous to the murder of the king; and yet by their own accounts form of the letters were then *actually un-*

VOL. X. Part II.

written. This is astonishing; and shows the extreme difficulty of carrying to any length a consistent series of falsehoods. Even Murray, Morton, and Lething- ton, could not do it. They knocked down one nine- pin in endeavouring to set up another; and they finally threw down all, by making them mutually and suc- cessively to strike one another.

We have not yet done with this act of council. It was with a view to the approaching convention of the estates that it had been formed and managed. It was a preparation for the parliament in which the conspira- tors had secured the fullest sway, and where they pro- posed to effectuate their pardon and security, and to establish the letters as decisive vouchers against the queen. Accordingly, upon the 15th day of December 1567, the three estates were assembled. The conspira- tors invited no candid or regular investigation. The friends of the nation and of the queen were overawed. Every thing proceeded in conformity to the act of council. The conspirators, by a parliamentary decree, received a full approbation of all the severities which they had exercised against the queen. A pardon by anticipation was even accorded to them for any future cruelty they might be induced to inflict upon her.— The letters were mentioned as the cause of this singu- lar law; and this new appeal to them may be termed the second mark of their distinction. But, amidst the plenitude of their power, the conspirators called not the estates to a free and honest examination of them. This, indeed, had the letters been genuine, would have annihilated for ever all the consequence of the queen. Upon this measure, however, they ventured not. The letters were merely produced in parliament, and an act founded on them; but the queen was not brought from her confinement to defend herself, nor was any advocate permitted to speak for her. We learn from a paper of unquestionable authenticity, that "findrie nobilmen that was her Grace's favouraris then present, buir with all (the rebel proceedings in this parliament), maist principellie for safety of hir Grace's lyfe, quhilk, or thair coming to parliament, was con- cludit and subscryvit be ane greit part of hir takeris, to be taken fra hir in meill crewel manner, as is no- tourlie known." By the power of this magic, the friends of Mary were bound fast. They durst not venture to question publicly the authenticity of the letters, from their dread of exposing the queen to the dagger of the assassin. The parliament, therefore, sustained these forgeries as vouchers of her guilt, without scrutiny or debate of any kind. The conspira- tors, who were themselves the criminals, were her accusers and her judges, and passed a law exactly in the terms in which the act of secret council had be- fore drawn it up.

It was necessary to describe the letters both in the act of council and in the ordination of parliament; and these deeds having fortunately descended to posterity, it is apparent, from a comparison of them, that between the 4th and the 15th days of December, the letters must have undergone very essential alterations under the management of the conspirators. In the act of council the letters are described expressly as "written and *subscryvit* with the queen's awin hand;" but in the act of parliament they are said to be only "written *heliie* with hir awin hand," and there is no

intimation.

Mary.

† See Whi-
taker's Vin-
dication.

Mary.

intimation that they were *subscribed* by her. Whence arises this difference? From a *blunder* in the clerk penning the act of council, says one: From a habit contracted by the same clerk, which made him *mechanically* add *subscribed* to *written*, says another: From the *carelessness* of the writer who transcribed the copy of the act of council which has descended to us, says a third. These subtleties have been exposed in all their weakness by Messrs Tytler and Whitaker: but in this abstract it is sufficient to observe, that they are mere suppositions, supported by no evidence; and that the copy of the act of council which we have was given to the ministers of Elizabeth by the leaders of the faction, who were neither blundering clerks, nor under the habit of mechanically adding *subscribed* to *written*. Under one form, therefore, the letters were certainly exhibited before the council, and under another form they were produced in parliament; but had they been genuine, they would have appeared uniformly with the same face. The clerk of the council was Alexander Hay, a notary public accustomed to draw up writings and to attest them; and what puts his accuracy with respect to the letters beyond all possibility of doubt, his description of them is authenticated in the fullest manner by the signatures of Murray, Morton, and a long train of others who formed the secret council. The letters, therefore, were actually presented to the secret council with the customary appendage of subscription to them. But when these artificers of fraud came to reflect more closely on the approach of parliament, and to prepare their letters for the inspection of the friends of Mary, they began to shrink at the thoughts of what they had done. To substantiate the charge by letters under her own hand, they had naturally annexed her own subscription, a letter *unsubscribed* being a solecism in evidence. But most unfortunately for the cause of complete forgery, Mary was still in possession of her own seal, and he who fabricated the letters was not an engraver. For this reason, "the allegit writings in form of missive letters or epistles," says the bishop of Ross, in an address to Elizabeth, "are not *sellis* nor *signetis*." They were neither attested by her subscription at the bottom, nor secured by her seal on the outside. In the secret council, where all were equally embarked in rebellion, these omissions were of no importance. But that letters, containing intimations of adultery and of murder, should be sent by the queen to the earl of Bothwell, with her *subscription* to them, and yet without any guard of a seal upon them, so far exceeds all the bounds of credibility, that they could not expect it to gain the belief of parliament. They were struck with the absurdity of their plan, and dreaded a detection. They were under the necessity of altering it; but they could not supply the defect of the seal. They, therefore, wrote over the letters anew, and with-held the subscription.

These letters were now as complete as the conspirators wished them; yet in this state, while they were unsubscribed and unsealed, they wanted other formalities which are usual in dispatches. They were without directions, and they had no dates. They must, therefore, have been sent by the queen to Bothwell as *open and loose papers*; yet they contained evidence against

herself, and against him, of the most horrid wickedness; and Nicholas Hubert, the person who is said to have carried most of them, was of the lowest condition, and, as Dr Robertson characterizes him, "a foolish talkative fellow." He would, therefore, surely read those papers, which are polluted from end to end with open and uncovered adultery, and as surely report their contents to others. These are most incredible circumstances, on the supposition that the letters are authentic, unless the queen was, what none of her enemies ever represented her, an absolute idiot.

The letters in their composition bear no resemblance to the other writings of the queen. They have a vulgarity, an indelicacy, and a coarseness of expression and manner, that by no means apply to her. They breathe nothing of the passion of love besides the impulses of the sensual appetite; and they represent a queen highly accomplished in love with one of her subjects, as acting with all the sneaking humility of a cottager to a peer. A few instances will show this. "The devil find us," she is made to exclaim, "and God knit us togidder for ever for the maist faithful coupill that ever he unitit: *this is my feith; I will die in it.*" "I am," she says in another place, "varrey glad to wryte unto zow quhen the reit are sleipand; sen I cannot sleip as they do, and as I would desire, that is, in your armes, my dear lufe." "Seeing to obey zow, my dear lufe, I spare nauther honor, conscience, basarde, nor greates quabatymer; tak it, I pray zow, in gude part, as from the maist faithful luifer that ever ze had, or ever fall have." "Se not hir (his wife), quahis fenzeit teires suld not be sa mikle preist nor elemis as the trew and faithful trevellis quihik I susteine for to merite her place." "God give zow, my only lufe, the hap and prosperitie quihik your humble and faithful lufe desires unto zow, who *hopis* to be shortly another thing to you for the reward of my irkesome travells." "When I will put you out of dout, and cleir myselve, *refuse* it not, my dear lufe; and suffer me to make zow fume prufe be my obedience, my faithfulness, constancie, and voluntary *subjection*, quihik I tak for the plesandest gude that I might reseit, *gif ze will except it.*" "Such (says Mr Whitaker) was the coarse *kirtle*, and the homely *necktie*, in which these wretched representatives of Mary dressed themselves up, for the exhibition of a queen dignified, refined, and elegant—a queen whom, according to their own account, "God had indowit with mony gude and excellent gifts and virtues!"

The evidence which points to the forgery of the letters is profuse and instructive. In its separate parts, it is powerful and satisfactory. When taken together, and in the union of its parts, it is invincible. But, amidst all its cogency and strength, there is a circumstance most peculiarly in its favour, and of which it required no aid or assistance. By this peculiarity, it is cased completely in steel, and armed at every point. The letters have come down to us in the French, the Scottish, and the Latin languages. Now the conspirators affirmed, that they were written by the queen in the French language. But by a critical examination of them in these different languages, Mr Goodall demonstrated, that the pretended French originals are a translation from the Latin of Buchanan.

Mary.

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Mary.

which is itself a version from the Scotch. This is indeed acknowledged by Dr Robertson, the ablest and most persevering of all Mary's enemies, who pretends, that, so far as he knows, it never was denied. Determined, however, to support the authenticity of the letters at all events, the same elegant and ingenious writer supposes †, that the French originals are now lost, but that two or three sentences of each of those originals were retained, and prefixed to the Scottish translation; and that the French editor observing this, foolishly concluded that the letters had been written partly in French and partly in Scottish. In support of this singular hypothesis, he proceeds to affirm, that "if we carefully consider those few French sentences of each letter which still remain, and apply to them that species of criticism by which Mr Goodall examined the whole, a clear proof will arise, that there was a French copy, not translated from the Latin, but which was itself the original from which both the Latin and Scottish have been translated." He accordingly applies this species of criticism, points out a few variations of meaning between what he calls the remaining sentences of the original French and the present Latin; and thinks, that in the former he has discovered a spirit and elegance which neither the Latin nor the Scottish have retained. His critical observations have been examined by Mr Whitaker; who makes it apparent as the noon-day sun, that the Doctor has occasionally mistaken the sense of the Latin, the French, and even the Scotch; and that he has *forgotten* to point out either the elegance or the spirit of any particular clauses in his pretended originals. The same masterly vindicator of Mary then turns his antagonist's artillery against himself; and demonstrates, that such variations as he has thought sufficient to prove the existence of a former French copy, are not confined to the first sentence of each of the three first letters, but are extended to other sentences, and diffused over all the letters. Hence he observes, that this mode of proving will demonstrate the *present* French, and *every* sentence in it, to be that very original, which it primarily pretended to be, which Mr Goodall has so powerfully proved it not to be, and which even the Doctor himself dares not assert it is. Our limits will not admit of our transcribing the observations of these two illustrious critics; nor is it necessary that we should transcribe them. By acknowledging that "Buchanan made his translation, not from the French but from the Scottish copy (of which he justly observes, that, were it necessary, several critical proofs might be brought)," Dr Robertson, in effect, gives up his cause. Had there been any other French letters than the present †, what occasion had Buchanan for the Scotch, when he himself must have had possession of the originals? It is evident from Mr Anderson's account, that those letters were translated by Buchanan at London during the time of the conferences. He was one of the assistants appointed to the rebel commissioners, and entrusted with the whole conduct of the process against the queen. By him, with Lethington, Macgill, and Wood, the original letters were exhibited, and their contents explained to the English commissioners; and we know from the authentic history of those papers, that they were neither lost nor mislaid for many years afterwards. It cannot be pre-

tended that Buchanan did not understand the French; for he past most of his life in that country, and taught a school there. He was, indeed, a daring zealot of rebellion; but, with all his audacity, he must have felt the task in which he was engaged a very ungracious one. When he sat down to defame, in the eyes of all Europe, a queen to whom he owed not only allegiance but also personal gratitude, it is not conceivable that he could have translated from a *Scotch translation*, had he known any thing of a *French original*; and if the rebel commissioners, who were said to produce them, knew nothing of such originals, certainly no body else ever did: if they existed not with Buchanan, they existed no where.

Dr Robertson, however, has another argument against Mr Goodall, which he thinks conclusive. Of the eight letters "the five remaining (he says) never appeared in Latin; nor is there any proof of their ever being translated into that language. Four of them, however, are published in French. This entirely overturns our author's hypothesis concerning the necessity of a translation into Latin."—An authentic fact will indeed overturn any hypothesis; but, most unluckily for this argument, the Doctor advances the hypothesis, and the fact rests with Mr Goodall. It is indeed true that Buchanan *published* only the three first letters in Latin at the end of his Detection; but it does not therefore follow, that the other five were never *translated into that language*. Indeed Mr Whitaker has made it as apparent as any thing can be, that the whole eight were turned into Latin for the use of the French translator, who, by his own account, understood not the Scotch. He has made it in the highest degree probable, that this translator was one *Gamus*, a French refugee; and he has demonstrated, that the translation was made in London under the eye of Buchanan himself. We do not quote his arguments, because they consist of a great number of observations which cannot be abridged; and because the translator himself confesses every thing which is of importance to the cause maintained by Mr Goodall. "Au reste (he tells us) *épistres mises sur la fin, which were all but the eighth, 'avaient été écrites par la Roynne, partie en François, partie en Ecossois; et depuis traductes ENTIEREMENT en LATIN: mais n'ayant cognoissance de la langue Ecossoise, j'ay mieux aimé exprimer tout ce, que j'ay trouve en LATIN, que,' &c.*" This confession (says Mr Whitaker) takes a comprehensive sweep. It makes all the seven letters at least, and the *whole* of each, to have been translated into Latin, and from thence to have been rendered into French. It starts no piddling objections about sentences or half-sentences, at the head or at the tail of any. It embraces all within its wide-spread arms. And it proves the fancied existence of a French copy at the time to be all a fairy vision; the creation of minds that have subjected their judgements to their imaginations; the invited dreams of self-delusion."

The letters, so weak on every side, and so incapable of sustaining any scrutiny, give the marks of suspicion and guilt in all the stages of their progress. Even with the parliamentary sanction afforded to them by the three estates, which the earl of Murray assembled upon the 15th day of December 1567, he felt the

Mary.

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† Tylor's Inquiry.

Mary. delicacy and the danger of employing them *openly* to the purposes for which they were invented. For while he was scheming with Elizabeth his accusation of the queen of Scots, he took the precaution to submit privately the letters to that princess by the agency of his secretary Mr Wood. The object of this secret transaction, which took place early in the month of June 1568, was most flagitious, and presses not only against the integrity of Murray, but also against that of the English queen. Before he would advance with his charge, he solicited from her an assurance that the judges to be appointed in the trial of Mary would hold the letters to be true and probative.

§ Stuart.

By the encouragement of Elizabeth, the earl of Murray was prevailed upon to prefer his accusation §. He was soon to depart for England upon this business. A privy-council was held by him at Edinburgh. He took up in it with formality the letters of the queen from the earl of Morton, and gave a receipt for them to that nobleman. That receipt is remarkable and interesting. It is dated upon the 16th day of September 1568, and contains the first mention that appears in history of the discovery of the letters as in the actual possession of Dalgleish upon the 20th of June 1567. This, as we have already noticed, is a very suspicious circumstance; but it is not the only suspicious circumstance which is recorded in the receipt. In the act of secret-council, and in the ordination of parliament, in December 1567, when the earl of Murray and his associates were infinitely anxious to establish the criminality of the queen, the only vouchers of her guilt to which they appealed were the letters; and at that time, doubtless, they had prepared no other papers to which they could allude. But in Murray's receipt in September 1568, there is mention of other vouchers beside the letters. He acknowledges, that he also received from the earl of Morton contracts or obligations, and sonnets or love-verses. These remarkable papers, though said to have been found upon the 20th of June 1567, appeared not till September 1568; and this difficulty is yet to be solved by those who conceive them to be genuine. The general arguments which affect the authenticity of the letters apply to them in full force; only it must be observed, that as the original letters were undoubtedly in Scotch, the original sonnets were as certainly written in French. This has been completely proved by Dr Robertson, and is fully admitted by Mr Whitaker, who has made it in the highest degree probable that Lethington forged the letters and Buchanan the sonnets. Be this as it may, the sonnets have every external and internal evidence of forgery in common with the letters, and they have some marks of this kind peculiar to themselves. In particular, they make the love of Mary still more grovelling than the letters made it; and with a degree of meanness, of which the soul of Lethington was probably incapable, the author of the sonnets has made the queen consider it as "na lytill honor to be maistress of her subject's guds!" In this the dignified princess is totally lost in "the maid Marien" of her pretended imitators; and Buchanan, who in his commerce with the sex was a mere sensualist, forgot on this occasion that he was personating a lady and a queen.

There is, however, in these sonnets, one passage of

singular importance, which we must not pass wholly unnoticed. The queen is made to say,

*Pour luy aussi j'ay jetté mainte larme,
Premier qu'il fust de ce corps possesseur,
Duquel alors il n'avoit pas le cœur.
Puis me donna un autre dur alarme,
Quand il versa de son sang mainte drague.*

For him also I powrit out my teyris,
First quhen he made himself possessor of this body,
Of the quhill then he had not the hart.
Efter he did give me ane uther hard charge,
Quhen he bled of his blude greit quantitie, &c.

If these sonnets could be supposed to be genuine, this passage would overthrow at once all the letters and both the contracts which were produced; and would prove, with the force of demonstration, that the seizure of Mary by Bothwell was *not* with her own consent; that he actually committed a *rape* upon her; that she had for him *no love*; and that the married him merely as a *refuge* to her *injured honour*. The sonnets, however, are undoubtedly spurious; but, considered in this light, the verses before us prove with equal force the full conviction in the minds of the rebels of what in an unguarded moment they actually confessed to Throgmorton, and was manifest to all the world: viz. that "the queen their sovereign was *led captive*, and by *fear, force*, and (as by many conjectures may be well suspected) other *extraordinary* and more *unlawful* means compelled to become bed-fellow to another wife's husband." They prove likewise, that after the rape, finding Mary highly indignant at the brutality done her, Bothwell actually flabbed himself; not, we may believe, with any intention to take away his own life, but merely that by shedding many a "drachm" of blood he might mollify the heart of the queen.

But we mean not to pursue the history of the sonnets any farther. Though they were undoubtedly invented in aid of the letters, to prove that fundamental principle of the conspirators,—that the love of Mary to Bothwell was inordinate; yet they are so incompatible with history, and with one another, that they demonstrate the spurioufness of themselves, and of the evidence which they were intended to corroborate. By thus endeavouring to give an air of nature and probability to their monstrous fictions, the rebels at once betrayed the fabrication of the whole. They have themselves supplied us with a long and particular journal, to show the true dates of facts; and by that journal have their letters and their sonnets been demonstrated to be spurious. "The makers of these papers (says Mr Whitaker) have broken through all the barriers of their own history. They have started aside from the orbit of their own chronology. They have taken a flight beyond the bounds of their own creation, and have there placed themselves conspicuous in the PARADISE OF FOOLS."

This mass of forgery was clandestinely shown to Elizabeth's commissioners during the conferences at York: (See SCOTLAND.) It was shown again to the same commissioners and others during the conferences at Westminster. But neither Mary nor her commissioners could ever procure a sight of a single letter or a single sonnet. By the bishop of Ross and the Lord Herties.

Mary. Herries she repeatedly demanded to see the papers said to be written by her; but that request, in itself so reasonable, Elizabeth, with an audacity of injustice of which the history of mankind can hardly furnish a parallel, thought fit to refuse. Mary then instructed her commissioners to demand copies of the letters and sonnets; and offered even from these to demonstrate in the presence of the English queen and parliament, and the ambassadors of foreign princes, that the pretended originals were palpable forgeries. Even this demand was denied her; and there is undoubted evidence still existing, that neither the nor her commissioners had so much as a copy of these criminal papers till after those important conferences had for some time been at an end. This last demand perplexed Elizabeth; the conferences were suddenly broken up; Murray was dismissed with his box to Scotland; and the letters were seen no more!

But the letters, we are told, were at Westminster compared with letters of the queen's, and found to be in the same Roman hand. They were indeed compared with other writings; but with what writings? This question let Elizabeth's commissioners themselves answer. They collated them, they say "with others her letters, which were shewed yesternight, and avowed by THEM (the rebel commissioners) to be written by the said queen." This was such a collation as

Whitaker must have pronounced them to be idiots &c, if we had not known them to be otherwise; and such as must pronounce them to be knaves, as we know them to have been men of sense. Like persons totally incompetent to the management of business, but in truth acting ministerially in the work of profligacy, they compared the letters produced, not with letters furnished by Mary's commissioners, not with letters furnished even by indifferent persons, but with letters *presented by the producers themselves*.—"This (says Mr Whitaker) is such an instance of imposition upon Mary and the world, as can scarcely be paralleled in the annals of knavery. Many instances of imposition, indeed, occur in the wretched history of our race; but we can hardly find one, in which the imposition was so gross, so formal, so important, and so clear. It was very gross, because it has not a shred of artifice to cover its ugly nakedness. It was very formal, because it was done by men some of whom were of the first character in their country; and all were bound by honour, and tied down by oaths, to act uprightly in the business. It was very important, because no less than the reputation of a queen, and the continuance of an usurpation, depended upon it. And it is very clear, because we have the fact related to us by

the commissioners themselves, recorded to their shame in their own journal, and transmitted by their own hands to posterity with everlasting infamy on their heads."

When Tytler's *Inquiry into the Evidence produced by the Earls of Murray and Morton against Mary Queen of Scots* was first published, it was reviewed in the Gentleman's Magazine by the late Dr Johnson. The review, which consists of a brief analysis of the work, with reflections interspersed on the force of the evidence, concludes thus:—"That the letters were forged is now made so probable, that perhaps they will never more be cited as testimonies." Subsequent experience has shown, that the great critic's knowledge of human nature had not deserted him when he guarded his prediction with the word *perhaps*. Few authors possess the magnanimity of Fenelon; and it is not to be expected that he who has once maintained the letters to be genuine, should by reasoning or criticism be compelled to relinquish them: but we are persuaded, that, after the present generation of writers shall be extinct, these letters and sonnets will never be cited as evidence, except of the profligacy of those by whom they were fabricated. Having said this, we leave the general character of Mary to the reflection of the reader (A).

She wrote, 1. Poems on various occasions, in the Latin, French, and Scotch languages. One of her poems is printed among those of A. Blackwood; another in Brantome's *Dames illustres*, written on the death of her first husband Francis. 2. Consolation of her long imprisonment, and royal advice to her son. 3. A copy of verses, in French, sent with a diamond-ring to queen Elizabeth. There is a translation of these verses among the Latin poems of Sir Thomas Chaloner. 4. Genuine Letters of Mary queen of Scots, to James earl of Bothwell; translated from the French, by E. Simmonds, 1726. There are, besides, many other of her epistles to queen Elizabeth, secretary Cecil, Mildmaye, &c. which are preserved in the Cottonian, Ashmolean, and other libraries.

MARY II. queen of England, eldest daughter of James II. by his first wife, was born at St James's in 1662. She was bred up a Protestant, and married to William Henry of Nassau, then prince of Orange, afterward king of England, in the 16th year of her age. She staid in Holland with her husband till February 12. 1689, when she came over, and was solemnly proclaimed queen of England, &c. She was an equal sharer with her husband in all the rights belonging to the crown; but the administration and execution thereof was lodged solely in the king. She was a princess endowed with the highest

(A) This article stands in need of an apology; but whether for its length or its shortness, our readers may perhaps differ in opinion. If it be considered as a piece of common biography, and compared with the limits which we have prescribed to our other articles of the same kind, it has swelled to an extent beyond all proportion. But as a piece of common biography it ought not to be considered: it is intimately connected with the history of Scotland at a very interesting period; and it has been justly observed, by one of the ablest writers of the age, that "the fact under dispute in the life of Mary, is a fundamental and essential one; and that, according to the opinion which the historian adopts with regard to it, he must vary and dispose the whole of his subsequent narration." Viewed in this light, our abstract of the evidence which has been urged on both sides of this controversy will by many be deemed too short. To such as wish for complete satisfaction, we can only recommend the unbiassed study of the writings of Buchanan, Leslie bishop of Ross, Goodall, Robertson, Hume, Tytler, Sir David Dalrymple, Stuart, and Whitaker.

Mary
Maryland.

est perfections both of body and mind : she loved history, as being proper to give her useful instructions ; and was also a good judge as well as a lover of poetry. She studied more than could be imagined, and would have read more than she did if the frequent returns of ill-humours in her eyes had not forced her to spare them. She gave her minutes of leisure to architecture and gardening ; and since it employed many hands, she said she hoped it would be forgiven her. She was the most gracious of sovereigns to her subjects, and the most obliging of wives to her husband, as well as the most excellent of mistresses to her servants : she ordered good books to be laid in the places of attendance, that persons might not be idle while they were in their turns of service. She was exceeding zealous for a reformation of manners ; charitable in the highest degree, without the least ostentation. This excellent queen died on the 28th of December 1695, at Kensington, of the small-pox, in the 33d year of her age. In her the arts lost a protectress, the unfortunate a mother, and the world a pattern of every virtue. As to her person, she was tall, of a majestic graceful mien, her countenance serene, her complexion ruddy, and her features beautiful.

MARY MAGDALEN'S DAY, a festival of the Romish church, observed on the 22d of July.

MARY-GERANE'S HOUSE, a name given to Dunmorehead, in the parish of Dunneen, county of Kerry, and province of Munster, in Ireland. It is the most western point of all Europe, and called by the Irish *Ty Vorney Geerone*. It is a point as much celebrated by them as John-of-Groat's-house by the Scots, which is the utmost extremity of North Britain.

MARYBOROUGH, a borough, market, and post town, and the assizes town to the Queen's county, in the province of Leinster, in Ireland, so called in honour of Mary queen of England, who reduced this part of the country to three-gird by act of parliament 6th and 7th Philip and Mary. It is governed by a burgo-master and bailiffs, and has a barrack for a troop of horse. It returns two members to parliament, and has five fairs. It is distant from Dublin 40 miles. N. Lat. 53. 0. W. Long. 7. 20.

MARYBURGH. See *FORT-WILLIAM*.

MARYGOLD. See *CALTHA*.

Corn MARYGOLD. See *CHRYSANTHEMUM*.

French MARYGOLD. See *TAIGETES*.

MARYLAND, one of the Thirteen United States of America. It received that name in honour of Henrietta Maria, the consort of king Charles I. who made a grant of this country, with very extraordinary powers, to Lord Baltimore. It lies between 38 and 40 degrees north latitude, and in longitude from 74 to 78 degrees west from London. It is bounded on the north by Pennsylvania ; on the east by the Delaware state ; on the south-east and south by the Atlantic Ocean, and a line drawn from the ocean over the peninsula (dividing it from Accomack county in Virginia) to the mouth of Patomack river, thence up the Patomack to its first fountain, thence by a due north line till it intersects the southern boundary of Pennsylvania, in lat. 39° 43' 18" ; so that it has Virginia on the south, south-west, and west. It contains about 14,000 square miles, of which about one-sixth is water. It is divided into 18 counties, 10 of which are on the

western and 8 on the eastern shore of Chesapeake bay, St Mary's, Somerset, Calvert, Montgomery, Washington, Queen Ann's, Caroline, Kent, Charles, Talbot, Dorchester, Baltimore, Ann Arundel, Worcester, Harford, Cecil, Frederick, and Prince George's. Each of the counties sends four representatives to the house of delegates ; besides which the city of Annapolis and town of Baltimore send each two, making in the whole 76 members. The climate is generally mild and agreeable, suited to agricultural productions and a great variety of fruit-trees. In the interior hilly country the inhabitants are healthy ; but in the flat country, in the neighbourhood of the marshes and stagnant waters, they are, as in the other southern states, subject to intermittents. Chesapeake bay divides this state into the eastern and western divisions. It affords several good fisheries ; and, in a commercial view, is of immense advantage to the state. It receives a number of the largest rivers in the United States. From the eastern shore in Maryland, among other smaller ones, it receives Pokomoke, Choptank, Chester, and Elk rivers ; from the north the rapid Susquehannah ; and from the west Patapsco, Severn, Patuxent, and Patomack, half of which is in Maryland and half in Virginia. Except the Susquehannah and Patomack, these are small rivers. East of the blue ridge of mountains, which stretches across the western part of this state, the land, like that in all the southern states, is generally level and free of stones. Wheat and tobacco are the staple commodities of Maryland. In the interior country, on the uplands, considerable quantities of hemp and flax are raised.

The number of inhabitants in this state, including the negroes, is 254,050 ; which is 18 for every square mile. The inhabitants, except in the populous towns, live on their plantations, often several miles distant from each other. To an inhabitant of the middle, and especially of the eastern states, which are thickly populated, they appear to live very retired and unsocial lives. The effects of this comparative solitude are visible in the countenances as well as in the manners and dress of the country people ; there being among them very little of that cheerful sprightliness of look and action which is the invariable and genuine offspring of social intercourse ; nor do they pay that attention to dress which is common, and which decency and propriety have rendered necessary, among people who are liable to receive company almost every day. As the negroes perform all the manual labour, their masters are left to saunter away life in sloth, and too often in ignorance. These observations, however, must in justice be limited to the people in the country, and to those particularly whose poverty or parsimony prevents their spending a part of their time in populous towns, or otherwise mingling with the world.

The chief towns in this state are Annapolis and Baltimore.—*Annapolis*, the capital, and the wealthiest town of its size in America, is situated just at the mouth of Severn river, 30 miles south of Baltimore. The houses are generally large and elegant ; and the state-house is the noblest building of the kind in America.—*Baltimore* has had the most rapid growth of any town on the continent, and is the fourth in size and the fifth in trade in the United States. It lies in lat. 39. 21. on the north side of Patapsco river.

Maryland.

Maryland. around what is called the *Bafon*. The situation of the town is low. The houses were numbered in 1787, and found to be 1955; about 1200 of which were in the town and the rest at Fell's point. The number of stores was 152; and of churches 9, which belong to German Calvinists and Lutherans, Episcopalians, Presbyterians, Roman Catholics, Baptists, Methodists, Quakers, Nicolites, or New Quakers. The number of inhabitants is between 10,000 and 11,000. There are many very respectable families in Baltimore, who live genteelly, are hospitable to strangers, and maintain a friendly and improving intercourse with each other; but the bulk of the inhabitants, recently collected from almost all quarters of the world, bent on the pursuit of wealth, varying in their habits, their manners, and their religions, if they have any, are unfocial, unimproved, and inhospitable. The trade of Maryland is principally carried on from Baltimore, with the other states, with the West Indies, and with some parts of Europe. To these places they send annually about 30,000 hogheads of tobacco, besides large quantities of wheat, flour, pig iron, lumber, and corn—beans, pork, and flax-seed, in smaller quantities; and receive in return, clothing for themselves and negroes, and other dry goods, wines, spirits, sugars, and other West India commodities. The balance is generally in their favour.

The Roman Catholics, who were the first settlers in Maryland, are the most numerous religious sect. Besides these, there are Protestant Episcopalians, English, Scots, and Irish Presbyterians, German Calvinists, German Lutherans, Friends, Baptists, Methodists, and Nicolites, or New Quakers. The colleges in this state have all been founded since the year 1782, and are yet in their infancy. The names of the several seminaries are, Washington College at Cheltenham, instituted in 1782; St John's College at Annapolis, founded in 1784; Cakesbury College at Abingdon, instituted by the Methodists in 1785; and a college founded by the Roman Catholics at Georgetown. There are a few other literary institutions, of inferior note, in different parts of the state, and provision is made for free schools in most of the counties: though some are entirely neglected, and very few carried on with any success; so that a great proportion of the lower class of people are ignorant, and there are not a few who cannot write their names. But the revolution, among other happy effects, has roused the spirit of education, which is fast spreading its salutary influences over this and the other southern states.

The legislature of this state is composed of two distinct branches, a senate and house of delegates; and styled *The General Assembly of Maryland*. The senate consists of 15 members, chosen every five years. Nine of these must be residents on the western shore and six on the eastern; they must be more than 25 years of age, must have resided in the state more than three years next preceding the election, and have real and personal property above the value of £.1000. The house of delegates is composed of four members for each county, chosen annually on the first Monday in October. The city of Annapolis and town of Baltimore send each two delegates. The qualifications of a delegate are, full age, one year's residence in the

county where he is chosen, and real or personal property above the value of £.500. The qualifications of a freeman are, full age, a freehold estate of 50 acres of land, and actual residence in the county where he offers to vote; property to the value of £.30 in any part of the state, and a year's residence in the county where he offers to vote.

On the second Monday in November annually a governor is appointed by the joint ballot of both houses. The governor cannot continue in office longer than three years successively, nor be elected until the expiration of four years after he has been out of office. The qualifications for the chief magistracy are, 25 years of age, five years residence in the state next preceding the election, and real and personal estate above the value of £.5000, £.1000 of which must be freehold estate. This constitution was established by a convention of delegates at Annapolis, August 14. 1776.

Maryland was granted, as has been already noticed, by King Charles I. to Cecilius Calvert, baron of Baltimore in Ireland, June 20. 1632. The government of the province was by charter vested in the proprietary; but it appears that he either never exercised these powers alone, or but for a short time. The honourable Leonard Calvert, Esq; Lord Baltimore's brother, was the first governor or lieutenant-general. In 1638, a law was passed, constituting the first regular house of assembly, which was to consist of such representatives, called *burgesses*, as should be elected pursuant to writs issued by the governor. These burgesses possessed all the powers of the persons electing them; but by any other freemen, who did not assent to the election, might take their seats in person. Twelve burgesses or freemen, with the lieutenant-general and secretary, constituted the assembly or legislature. This assembly sat at St Mary's, one of the southern counties, which was the first settled part of Maryland. In 1689, the government was taken out of the hands of Lord Baltimore by the grand convention of England. Mr Copley was appointed governor by commission from William and Mary in 1692, when the Protestant religion was established by law. In 1716, the government of this province was restored to the proprietary, and continued in his hands till the late revolution; when, being an absentee, his property in the lands was confiscated, and the government assumed by the freemen of the province, who formed the constitution now existing. At the close of the war, Henry Harford, Esq; the natural son and heir of Lord Baltimore, petitioned the legislature of Maryland for his estate; but his petition was not granted. Mr Harford estimated his loss of quit-rents, valued at 20 years purchase, and including arrears, at £.259,488, 5s.—dollars at 7s. 6d. and the value of his manors and reserved lands at £.327,441 of the same money.

MARYPORT, a sea-port town of Cumberland, situated at the mouth of the Elne. It has a good harbour; and has 70 or 80 sail of shipping from 30 to 250 tons burden, principally employed in the coal-trade; some of them fail up the Baltic for timber, flax, iron, &c. They have a furnace for cast-iron and a glass-house. A chapel was erected here in 1760.

MAS (Lewis du), natural son to Jean Louis de Montcalm.

Maryland
||
Mas.

—Mas,
Masluero.

Montcalm Seigneur de Candiac, and a widow of rank of Rouergue, was born at Nîmes in 1676. His first attention was bestowed on jurisprudence; but afterwards he was altogether occupied with mathematics, philosophy, and the study of the languages. Father Mallebranche cultivated his acquaintance and esteemed his virtues. His first appearance was severe, his general temper tranquil; yet he had a lively and fertile imagination. His mind was active, full of resources, and methodical. We are indebted to his industry for the Typographical Bureau. This invention is the more ingenious, as it presents the tedious parts of education, namely, reading, writing, and the elements of languages, to the youthful mind as a delightful entertainment, and many people in France both in the capital and in the provinces have adopted it with success. After he had conceived the idea of this invention, he made the first trial of it on the young Candiac, who was remarkable for his understanding in his earliest years. Du Mas conducted his pupil to Paris and the principal cities in France, where he was universally admired. This prodigy was carried off in the year 1726 before he was seven years of age, and his loss had nearly deprived Du Mas of his reason. A dangerous illness was the consequence of his vexation; and he would have died of want, if a gentleman had not taken him from his garret and entertained him in his own house. Du Mas afterwards retired with Madame de Vaujour within two leagues of Paris, and died in the year 1774, aged 68. He was a philosopher both in genius and character. His works are, 1. *L'Art de transporter toutes sortes de Musiques sans être obligé de connoître, ni le temps, ni le mode*, published at Paris in 4to, 1711. This work is extremely curious, but of no advantage to the study of music. 2. A volume in quarto, printed at Paris 1733, in four parts, intitled, *Bibliothèque des enfans*. In this treatise he has placed, in a clear point of view, the system and economy of his Typographical Bureau. This invention, like every thing new, was censured by some and admired by others. The author himself defended it with much success in the journals and in several occasional pamphlets. This collection, however, is become exceedingly scarce. The Typographical Bureau was brought to perfection by M. Reybert a citizen of Avignon, who enriched it with many articles containing useful and agreeable information in geography, history, fable, &c. &c. 3. *Mémoires de l'Ecluse sous le regne de Marie Stuart*, by Crawford, and translated from the English. This translation was found in manuscript in the library of the late marquis d'Aubais, with whom du Mas had lived in the most intimate habits of friendship.

Mas Planta, a plant which upon the same root produces male flowers only. See *MASCULUS Flor.*

MASAFUERO, an island of the South-Sea, lying in S. Lat. 33. 45. W. Long. 80. 46. It is very high and mountainous, and at a distance seems to consist of one hill or rock. It is of a triangular form, and seven or eight leagues in circumference. There is such plenty of fish, that a boat with a few hooks and lines may very soon catch as many as will serve 100 people. Here are coal-fish, cavilliers, cod, halibut, and cray-fish. Captain Carteret's crew caught a kingfisher that weighed 87 pounds, and was five feet and

an half long. The sharks were here so ravenous, that, in taking soundings, one of them swallowed the lead, by which they hauled him above water; but he regained his liberty by disgorging his prey. Seals are so numerous here, that Captain Carteret says, if many thousands were killed in a night, they would not be missed next morning. These animals yield excellent train-oil; and their hearts and plucks are very good food, having a taste something like those of a hog; their skins are covered with a very fine fur. There are many birds here, and some very large hawks. Of the pintado bird one ship caught 700 in one night. Commodore Byron landed here with difficulty in 1765, in order to take in wood and water, of both which he found plenty. He found also great numbers of goats, whose flesh tasted as well as venison in England.

MASBOTHÆI, or MESBOTHÆI, the name of a sect, or rather of two sects; for Eusebius, or rather Hegesippus whom he cites, makes mention of two different sects of Masbothæans. The first was one of the seven sects that arose out of Judaism, and proved very troublesome to the church; the other was one of the seven Jewish sects before the coming of Jesus Christ.

The word is derived from the Hebrew שבת, *schabat*, "to rest or repose," and signifies *idle easily indolent people*. Eusebius speaks of them as if they had been so called from one Masbothæus their chief: but it is much more probable that their name is Hebrew, or at least Chaldaic, signifying the same thing with a Sabbatarian in our language; that is, one who makes profession of keeping Sabbath.

Valeius will not allow the two sects to be confounded together: the last being a sect of Jews before, or at least contemporary with Christ; and the former a sect of heretics descended from them. Rufinus distinguishes them in their names: the Jewish sect he calls Masbuthæi; and the heretics Masbuthæani. The Masbuthæans were a branch of the Simonians.

MASCARDI (Augustin), a distinguished person in the republic of letters, was born at Sarzane, a city of the state of Genoa, in 1591. He spent the early part of his life among the Jesuits, and afterwards became chamberlain to Pope Urban VIII. He was naturally so eloquent, that this same pope, merely to exercise his talent, founded a professorship of rhetoric for him in the college de la Sapienza 1628, and settled upon him for life a pension of 500 crowns. Mascardi filled the chair with great reputation; but his love of letters made him neglect what is of more consequence than even letters, the management of his affairs: for he was always poor, and always in debt. He wrote a great many things in verse and prose; and among the rest, a treatise intitled *Dell' arte historica*. In his "History of the Conspiracy of the Comtede Fiesque," he has very frequently attacked the religion of Hubert Folietta; and in his other books he used some writers in the same way, which occasioned him to be attacked in his turn. The objections which were made to him, together with his answers, were added to the second edition of the history just mentioned. He died at Sarzane, 1640, in his 49th year.

MASCARON (Julius), bishop of Agen, and a most eminent French preacher, was born at Marcellis in

Masbothæi
Masfaron.

*Masclaf,
Masculine*

in 1634. He inherited of his father, who was the most celebrated advocate of the parliament of Aix, that uncommon talent of eloquence which distinguished him. He was admitted a member of the congregation of the oratory very young; and from his 22d year taught rhetoric at Mans. Soon after this he commenced preacher, and preached with great success in St Peter's church at Saumur. The bishop of Mans, willing to engage so able a preacher in his church, made him prebendary of it. He was much admired at Paris, when he preached the advent at the oratory. He preached after this five or six years at court, and was promoted to the bishopric of Tulle in 1671. He was afterwards translated to the bishopric of Agen. He was called in 1694 to preach the Lent sermon at court. The year following, he opened the assembly of the clergy, and returned to his diocese; where he died of a dropy in his chest, Dec. 16. 1703. There is nothing printed of this great man excepting A Collection of Funeral Orations made upon the queen-mother, the dauphiness, the duke of Beaufort, the chancellor Seguier, marshal Turenne; and at the head of this collection there is a short life of him.

MASCLEF (Francis), was at first a curate in the diocese of Amiens, the place of his birth, and afterwards theologian and confidant to the virtuous De Brou bishop of that diocese. He was appointed to the charge of a seminary of learning under that prelate. He deserved this employment both from his piety and profound learning. The oriental languages were as familiar to him as his native tongue. He pursued his researches into the idioms of the east with the spirit and the ingenuity of a philosopher. He was made canon of Amiens a little before the death of De Brou, which happened in 1706. His opinions on the Janesist controversy were so offensive to Sabbatier, the successor of that worthy prelate, that he was removed from the care of the seminary and from almost every other public office which he held. The regard of the dead comforted Masclaf under the oppression of the living. He devoted himself to study with so much ardour, that he contracted a disease of which he died the 14th Nov. 1728, aged 66 years. His principal works are, 1. A Hebrew Grammar in Latin, after his new method, printed at Paris 1716, in 12mo. This grammar was again printed in two volumes in 12mo in the year 1730, under the direction of M. de la Bletterie at that time priest of the oratory and the friend of Masclaf. All the objections which Father Guarin made in his Hebrew grammar to Masclaf's method of reading Hebrew without the use of points are attended to in this edition. There is nothing more necessary, according to this plan, than to take the vowel which is next the consonant in the order of the alphabet. This method was approved of by some learned men, but rejected by a great many more. 2. *Les Conférences Ecclésiastiques du diocèse d'Amiens*, in 12mo. 3. *Le Catéchisme d'Amiens*, in 4to. 4. *Une Philosophie et une Théologie*, in MS. These would have been published had they not discovered a partiality to the principles of Janesism. The author was an austere man, equally respectable for his manners and his knowledge.

MASCULINE, something belonging to the male, or the stronger of the two sexes. See MALE.

Vol. X. Part II.

MASCULINE, is more ordinarily used in grammar to signify the first and worthiest of the genders of nouns. See GENDER.

The masculine gender is that which belongs to the male kind, or something analogous to it.

Most substances are ranged under the heads of masculine or feminine.—This, in some cases, is done with a show of reason; but in others is merely arbitrary, and for that reason is found to vary according to the languages and even according to the words introduced from one language into another.—Thus the names of trees are generally feminine in Latin and masculine in the French.

Farther, the genders of the same word are sometimes varied in the same language. Thus *aloué*, according to Priscian, was anciently masculine, but is now become feminine. And *navire*, “a ship,” in French, was anciently feminine, but is now masculine.

MASCULINE RHYME, in the French poetry, is that made with a word which has a strong, open, and accented pronunciation; as all words have, excepting those which have an *e* feminine in their last syllable. For instance, *amour* and *jour*, *mort* and *fort*, are masculine rhymes; and *pere* and *mere*, *gloire* and *memoire*, are feminine. Hence also verses ending with a masculine rhyme, are called *masculine verses*, and those ending with a feminine rhyme, *feminine verses*. It is now a rule established among the French poets never to use the above two masculine or two feminine verses successively, except in the looser kind of poetry. Marot was the first who introduced this mixture of masculine and feminine verses, and Ronsard was the first who practised it with success. The masculine verses should always have a syllable less than the feminine ones.

MASCULINE SIGNS. Astrologers divide the signs into masculine and feminine; by reason of their qualities, which are either active, and hot or cold, accounted masculine; or passive, dry and moist, which are feminine. On this principle they call the Sun, Jupiter, Saturn, and Mars, *masculine*; and the Moon and Venus *feminine*. Mercury, they suppose, partakes of the two. Among the signs, Aries, Libra, Gemini, Leo, Sagittarius, Aquarius, are masculine: Cancer, Capricornus, Taurus, Virgo, Scorpio, and Pisces, are feminine.

MASCULUS FLOS, in botany. See FLOS.

MASH, a drink given to a horse, made of half a peck of ground malt put into a pail, into which as much scalding hot water is poured as will wet it very well: when that is done, stir it about, till, by tasting, you find it as sweet as honey; and when it has stood till it is lukewarm, it is to be given to the horse. This liquor is only used after a purge, to make it work the better; or after hard labour, or instead of drink in the time of any great sickness.

MASK. See MASQUE.

MASINISSA, a king of a small part of Africa, who at first assisted the Carthaginians in their wars against Rome; but afterwards joined the Romans, and became the firmest ally they ever had. See NUMIDIA.

MASON, a person employed under the direction of an architect, in the raising of a stone-building.

*Masculine
Mason,*

The chief business of a mason is to make the mortar; raise the walls from the foundation to the top, with the necessary retreats and perpendiculars; to form the vaults, and employ the stones as delivered to him. When the stones are large, the business of hewing or cutting them belongs to the stone-cutters, though these are frequently confounded with masons: the ornaments of sculpture are performed by carvers in stones or sculptors. The tools or implements principally used by them are the square, level, plumb-line, bevel, compass, hammer, chisel, mallet, saw, trowel, &c. See SQUARE, &c.

Besides the common instruments used in the hand, they have likewise machines for raising of great burdens, and the conducting of large stones; the principal of which are the lever, pulley, wheel, crane, &c. See LEVER, &c.

Free and Accepted MASONS, a very ancient society or body of men: so called, either from some extraordinary knowledge of masonry or building, which they are supposed to be masters of, or because the first founders of the society were persons of that profession. These are now very considerable, both for number and character, being found in every country in Europe, and consisting principally of persons of merit and consideration. As to antiquity, they lay claim to a standing of some thousand years. What the end of their institution is, seems still in some measure a secret; and they are said to be admitted into the fraternity by being put in possession of a great number of secrets, called the *mason's word*, which have been religiously kept from age to age, being never divulged. * See *Free-Masonry*.

MASONRY, in general, a branch of architecture, consisting in the art of hewing or squaring stones, and cutting them level or perpendicular, for the uses of building: but, in a more limited sense, masonry is the art of assembling and joining stones together with mortar.

Hence arise as many different kinds of masonry as there are different forms and manners for laying or joining stones. Vitruvius mentions several kinds of masonry used among the ancients: three of hewed stone, viz. that in form of a net, that in binding, and that called the *Greek masonry*; and three of unhewed stones, viz. that of an equal course, that of an unequal course, and that filled up in the middle; and the seventh was a composition of all the rest.

Net-masonry, called by Vitruvius *reticulatum*, from its resemblance to the meshes of a net, consists of stones squared in their courses, and so disposed as that their joints go obliquely; and their diagonals are the one perpendicular and the other level. This is the most agreeable masonry to the eye, but it is very apt to crack. See N^o 1.

Bound-masonry, that in which the stones were placed one over another, like tiles; the joints of their beds being level, and the mounters perpendiculars, so that the joint that mounts and separates two stones always falls directly over the middle of the stone below. This is less beautiful than the net-work; but it is more solid and durable. See N^o 2.

Greek masonry, according to Vitruvius, is that where after we have laid two stones, each of which makes a course, another is laid at the end, which makes two

courses, and the same order is observed throughout the building; this may be called *double-binding*, in regard the binding is not only of stones of the same course with one another, but likewise of one course with another course. See N^o 3.

Masonry by equal courses, called by the ancients *isodomum*, differs in nothing from the bound masonry, but only in this, that its stones are not hewn. See N^o 4.

Masonry by unequal courses, called *pseudisodomum*, is also made of unhewed stones, and laid in bound work; but then they are not of the same thickness, nor is there any equality observed excepting in the several courses, the courses themselves being unequal to each other. See N^o 5.

Masonry filled up in the middle, is likewise made of unhewed stones, and by courses; but the stones are only set in order as to the courses: (See N^o 9). A, the courses; B, the parts filled up; C, a coat of plaster.

Compound masonry is of Vitruvius's proposing, so called as being formed of all the rest. In this the courses are of hewed stone; and the middle being left void, is filled up with mortar and pebbles thrown in together: after this the stones of one course are bound to those of another course with iron-cramps fastened with melted lead: (See N^o 7). E, the stones cramped; F, the cramps; G, the middle part filled up.—N^o 8. represents another sort of compound masonry, the middle of which is stone, and the edges boards.

All the kinds of masonry now in use may be reduced to these five, viz. bound masonry; that of brick-work, where the bodies and projectures of the stones inclose square spaces or pannels, &c. set with bricks; that de moilon, or small work, where the courses are equal, well squared, and their edges or beds ruffled; that where the courses are unequal; and that filled up in the middle with little stones and mortar.

Free-Masonry, denotes the system of mysteries and secrets peculiar to the society of free and accepted masons.

The origin of this society is very ancient; but we have no authentic account of the time when it was first instituted, or even what was the reason of such an association of people under the title of *Masons*, more than of any other mechanical profession.—In Dr Henry's history we find the origin of the Free Mason Society in Britain attributed to the difficulty found in former times, of procuring a sufficient number of workmen to build the multitude of churches, monasteries, and other religious edifices which the superstitution of those ages prompted the people to raise. Hence the masons were greatly favoured by the popes, and many indulgences were granted in order to augment their numbers. In times like those we speak of, it may well be supposed that such encouragement from the supreme pastors of the church must have been productive of the most beneficial effects to the fraternity; and hence the increase of the society may naturally be deduced. The Doctor quotes, in confirmation of this, the words of an author who was well acquainted with their history and constitution. "The Italians (says he), with some Greek refugees, and with them French, Germans, and Flemings, joined

Masonry. ed into a fraternity of architects, procuring papal bulls for their encouragement and their particular privileges; they styled themselves *Free-masons*, and ranged from one nation to another, as they found churches to be built: their government was regular; and where they fixed near the building in hand, they made a camp of huts. A surveyor governed in chief; every tenth man was called a *warden*, and overlooked each nine. The gentlemen in the neighbourhood, either out of charity or commutation of penance, gave the materials and carriages. Those who have seen the accounts in records of the charge of the fabrics of some of our cathedrals near 400 years old, cannot but have a great esteem for their economy, and admire how soon they erected such lofty structures."

By other accounts, however, the antiquity of masonry is carried up much higher, even as early as the building of Solomon's temple. In Britain the introduction of masonry has been fixed at the year 674, when glass-making was first introduced; and it appears indeed, that from this time many buildings in the Gothic style were erected by men in companies, who are said to have called themselves *free*, because they were at liberty to work in any part of the kingdom. Others have derived the institution of free masons from a combination among the people of that profession not to work without an advance of wages, when they were summoned from several counties, by writs of Edward III. directed to the sheriffs, to assist in rebuilding and enlarging the castle, together with the church and chapel of St George at Windsor. At this time, it is said, the masons agreed on certain tokens by which they might know and assist each other against being imposed, and not to work unless free and on their own terms.

In a treatise on Masonry published in 1792 by William Preston, master of the Lodge of Antiquity, the origin of masonry is traced from the creation. "Ever since symmetry began, and harmony displayed her charms (says he), our order has had a being." Its introduction into England he likewise supposes to have been prior to the Roman invasion. There are, according to him, the remains yet existing, of some stupendous works executed by the Britons much earlier than the time of the Romans; and even these display no small share of ingenuity of invention: so that we can have no doubt of the existence of masonry in Britain even during these early periods. The Druids are likewise said to have had among them many customs similar to those of the masons, and to have derived their government from Pythagoras; but the resemblance betwixt their usages and those of the free-mason societies now existing cannot be accurately traced even by the masons themselves.

Masonry is said to have been encouraged by Cæsar, and many of the Roman generals who were appointed governors of Britain: but though we know, that at this period the fraternity were employed in erecting many magnificent fabrics, nothing is recorded concerning their lodges and conventions; and we have but a very imperfect account of the customs which prevailed in their assemblies.

For a long time the progress of masonry in Britain was obstructed by the frequent wars which took place; and it did not revive till the time of Carausius,

by whom it was patronised. This general, who hoped to be the founder of a British empire, encouraged learning and learned men; collecting also the best artificers from many different countries, particularly masons, whom he held in great veneration, and appointing Albanus his steward the principal superintendent of their assemblies. Lodges, or conventions of the fraternity, began now to be introduced, and the business of masonry to be regularly carried on. The masons, through the influence of Albanus, obtained a charter from Carausius to hold a general council, at which Albanus himself sat president, and assisted at the reception of many new members. This Albanus was the celebrated St Alban, the first who suffered martyrdom in Britain for the Christian faith. Mr Preston quotes an old MS. destroyed with many others, said to have been in the possession of Nicholas Stone, a curious sculptor under Inigo Jones; from which we learn that St Alban was a great friend to masons, and gave them two shillings per week besides threepence for their cheer; while, before that time, they had no more than one penny per day and their meat. He likewise obtained "a charter from the king and his council for them to hold a general council, which was named an *assembly*." The same circumstances are mentioned in a MS. written in the time of James II. only this increases the weekly salary of the masons to 3s. 6d. and 3d. per day for the bearers of burthens.

The progress of masonry was greatly obstructed by the departure of the Romans from Britain; and in a short time fell into absolute neglect. This was occasioned first by the furious irruptions of the Scots and Picts, which left no time for the cultivation of the arts; and afterwards by the ignorance of the Saxons, whom the ill-advised Britons called in as allies, but who soon became their masters. After the introduction of Christianity, however, the barbarity of these conquerors began to wear off, the arts received some encouragement, and masonry particularly began to flourish. Lodges were now formed; but these being under the direction of foreigners, were seldom convened, and never attained to any degree of consideration or importance. In this situation it continued till the year 557, when St Austlin, with 40 more monks, among whom the sciences had been preserved, came into England. By these the principles of Christianity were propagated with such zeal, that all the kings of the heptarchy were converted; after which masonry was taken under the patronage of St Austlin, and the Gothic style of building was introduced into England by the numerous foreigners who resorted at this time to the kingdom. Austlin himself appeared at the head of the fraternity in founding the old cathedral of Canterbury in 600; that of Rochester in 602; St Paul's in London in 604; St Peter's in Westminster in 605, as well as many others. The number of masons in England was thus greatly increased, as well as by his other buildings of castles, &c. throughout the kingdom.

In 640 a few expert brethren arrived from France, and formed themselves into a lodge under the direction of Bennet abbot of Wirral; whom Kenred king of Mercia soon after appointed inspector of the lodges, and general superintendent of the masons. During

Masonry

the whole time of the heptarchy, however, masonry was in a low state, but began to revive in 856 under the patronage of St Swithin, whom Ethelwolf employed to repair some religious houses; and from that time the art gradually improved till the year 872, when it found a zealous protector in Alfred the Great. This prince was a most eminent patron of all kinds of arts and manufactures; and, with regard to masonry in particular, he appropriated a seventh part of his revenue for maintaining a number of workmen, whom he constantly employed in rebuilding the cities, castles, &c. ruined by the Danes. During the reign of his successor Edward, the masons continued to hold their lodges under the sanction of Ethred, husband to the king's sister, and Ethelward his brother, to whom the care of the fraternity was intrusted. The latter was a great architect, and founded the university of Cambridge.

The true re-establishment of masonry in England, however, is dated from the reign of King Athelstane; and there is still extant a grand lodge of masons at York, who trace their existence from this period. This lodge, the most ancient in England, was founded in 926, under the patronage of Edwin the king's brother, who obtained for them a charter from Athelstane, and became grand master himself. By virtue of this charter it is said, that all the masons in the kingdom were convened at a general assembly in that city, where they established a general or grand lodge for their future government. Under the patronage and jurisdiction of this lodge it is also alleged that the fraternity increased very considerably, and that kings, princes, and other eminent persons who had been initiated into the mysteries, paid due allegiance to the assembly. But as the times were yet turbulent and barbarous, the art of masonry was sometimes more sometimes less patronised; and of course the assembly more or less respected according to the respect which the art itself met with. The appellation of *ancient York masons* is well known both in Ireland and Scotland; and the general tradition is, that they originated at Auldby near York; and as Auldby was a seat of Edwin, this tradition gives considerable confirmation to the above account. There is indeed great reason to believe that York was the original seat of masonic government, no other place having claimed it, and the whole fraternity having at various times owned allegiance to the authority there established; though we know not whether that allegiance be now given or not. Certain it is, that if such a lodge was once established there, of which there is no reason to doubt, we have no account of its being regularly moved from that place to any other part of the kingdom with consent of its members. Many respectable meetings have indeed been held at different times in other parts of the kingdom, but there is no account of any other general meeting being held in another place than York till very lately.

While prince Edwin lived, the masons were employed as formerly in building churches, monasteries, &c. and repairing those which had suffered by the ravages of the Danes; and after his death the order was patronised by king Athelstane himself; but on his decease the masons were dispersed, and remained in an unsettled state till the reign of Edgar in 960. They

Masonry

were now collected by St Dunstan, who employed them in works of the same kind; but as no permanent encouragement was given them, their lodges soon declined, and masonry remained in a low state for upwards of 50 years. It revived, however, in 1041, under Edward the Confessor, who superintended the execution of several great works. By the assistance of Leofrick earl of Coventry, he rebuilt Westminster Abbey, the earl being appointed superintendent of the masons; and by this architect many other magnificent structures were likewise erected. After the Conquest, in 1066, Gundulph bishop of Rochester and Roger de Montgomery earl of Shrewsbury, both of them excellent architects, became joint patrons of the masons; and under their auspices the Tower of London was begun, though finished only in the reign of William Rufus, who likewise rebuilt London Bridge with wood, and in 1087 first constructed the palace and hall of Westminster.

The masons now continued to be patronised by the sovereigns of England in succession. The lodges assembled during the reign of Henry I. and during that of Stephen, the society were employed in building a chapel at Westminster, now the House of Commons, and several other works; the president of the lodges being now Gilbert de Clare, the marquis of Pembroke. During the reign of Henry II. the lodges were superintended by the grand-master of the Knights Templars, who employed them in building their temple in Fleet-Street in the year 1155. Masonry continued under the patronage of this order till the year 1199, when John succeeded Richard I. in the throne of England, and Peter de Colechurch was then appointed grand-master. He began to rebuild London bridge with stone, which was afterwards finished by William Alemain in 1209. Peter de Rupibus succeeded Peter de Colechurch in the office of grand-master, and Geoffrey Fitz-Peter, chief surveyor of the king's works, acted as deputy under him; masonry continued also to flourish under the auspices of these two artists during this and the following reign. On the accession of Edward I. in 1272, the superintendence of the masons was entrusted to Walter Giffard archbishop of York, Gilbert de Clare earl of Gloucester, and Ralph lord of Mount Hermer, the progenitor of the family of the Montagues; and by these architects the abbey of Westminster was finished, after having been begun in 1220, during the minority of Henry II. During the reign of Edward II. the fraternity were employed in building Exeter and Oriol Colleges in Oxford, Clare-hall in Cambridge, &c. under the auspices of Walter Stapleton bishop of Exeter, who had been appointed grand-master of the masons in 1307.

Edward III. was a great encourager of learning in general, and not only patronised the masons, but applied very assiduously to the constitutions of the order, revised and meliorated the ancient charges, and added several useful regulations to the original code by which the fraternity had been governed. He patronised the lodges, and appointed five deputies under him to inspect their proceedings; and at this period it appears from some old records, that the lodges were numerous, and that the fraternity held communications under the protection of the civil magistrates. William a Wykeham was continued grand-master on the accession of Richard

Masonry. Richard II. and by him both the New College in Oxford and Winchester College were founded at his own expense. After the accession of Henry IV. Thomas Fitz-Allan earl of Surrey was appointed grand-maſter, who, after the engagement at Shrewsbury, founded Battle-abbey and Fotheringay; the Guildhall at London being alſo built in this reign. On the acceſſion of Henry V. the fraternity were directed by Henry Chicheley archbiſhop of Canterbury, under whom the lodges and communications of the fraternity were frequent. In 1425, however, during the reign of Henry VI. an act was made againſt the meetings of the chapters and congregations of maſons, becauſe it was ſaid, that by ſuch meetings “the good courſe and effect of the ſtatutes of labourers were openly violated and broken, in ſubverſion of the law, and to the great damage of all the commons.” But this act was not put in force, nor did the fraternity ceaſe to meet as uſual under the protection of archbiſhop Chicheley, who ſtill continued to preſide over them. The reaſon of this extraordinary edict is ſaid to have been as follows. The duke of Bedford, at that time regent of the kingdom, being in France, the regal power was veſted in his brother Humphrey duke of Glouceſter, who was ſtyled protector and guardian of the kingdom. The care of the young king’s perſon and education was entrusted to Henry Beaufort biſhop of Wincheſter, the duke’s uncle. This prelate being of an ambitious diſpoſition, and aſpiring at the ſole government, had continual diſputes with his nephew the protector; and by reaſon of the violent temper of that prince, gained frequent advantages over him. This animosity increaſed to ſuch a degree, that the parliament was at length obliged to interpoſe. On the meeting of that aſſembly in the month of April 1425, however, the ſervants and followers of the peers came thither, armed with clubs and ſtaves; on which account it received the name of the *Bat Parliament*, and at this time the act againſt maſons was made. This was owing to the influence of the biſhop, who wiſhed to deſtroy the meetings of the fraternity on account of the ſecrecy obſerved in them. Dr Anderſon, in the firſt edition of the Book of Conſtitutions, makes the following obſervation upon this act: “It was made in ignorant times, when true learning was a crime, and geometry condemned for conjuration; but it cannot derogate from the honour of the ancient fraternity, who, to be ſure, would never encourage any ſuch confederacy of their working brethren. By tradition, it is believed that the parliament were then too much influenced by the illiterate clergy, who were not accepted of maſons, nor underſtood architecture (as the clergy of ſome former ages), and were generally thought unworthy of this brotherhood. Thinking they had an inalienable right to know all ſecrets by virtue of auricular confeſſion, and the maſons never confeſſing any thing thereof, the ſaid clergy were highly offended; and at firſt, ſuſpecting them of wickedneſs, repreſented them as dangerous to the ſtate during that minority; and ſoon influenced the parliament to lay hold of ſuch ſuppoſed arguments of the working maſons for making an act that might ſeem to reflect diſhonour upon even the whole fraternity, in whole favour ſeveral acts had been made before that period, and were made after it.”

The biſhop was ſoon after this diverted from his perſecution of the maſons by an affair of a more important kind. He had formed a deſign of ſurpriſing the city of London on the evening of St Simon and St Jude’s day, that on which the Lord Mayor was inveſted with his office. But the plot having been diſcovered by the duke of Glouceſter, the Mayor was ſent for while at dinner, and ordered to keep a ſtrict watch for that night. The biſhop’s party accordingly made an attempt to enter by the bridge about nine the next morning, but were repulſed by the vigilance of the citizens. At this the prelate was ſo much enraged, that he collected a numerous body of archers and men at arms, commanding them to aſſault the gate with ſhot. By the prudence of the magiſtrates, however, all violent meaſures were ſtopped; but no reconciliation could be procured betwixt the two parties, though it was attempted by the archbiſhop of Canterbury, and Peter duke of Coimbra, eldeſt ſon to the king of Portugal, with ſeveral other perſons of diſtinction. At laſt the biſhop wrote a letter to the duke of Bedford, urging his return to England, and informing him of the danger there was of a civil war, and reflecting upon the duke of Glouceſter. This letter had the deſired effect. The regent returned, and held a great council at St Albans on the 21ſt of February, but adjourned it to the 15th of March at Northampton, and to the 25th of June at Leiſceſter. Bats and ſtaves were now prohibited at theſe meetings; but the parties aſſembled with weapons no leſs formidable, viz. with ſlings, ſtones, and leaden plummetts. The duke of Bedford employed all his authority to reconcile the differences; and at laſt obliged the two rivals to promiſe before the aſſembly that they would bury all animosities in oblivion. During the diſcuſſion of this matter five charges were exhibited by the duke of Glouceſter againſt the biſhop; one of which was, that “he had, in his letter to the duke of Bedford, at France, plainly declared his malicious purpoſe of aſſembly the people, and ſtirring up a rebellion in the nation, contrary to the king’s peace.” To this the biſhop answered, “That he never had any intention to diſturb the peace of the nation or raiſe a rebellion; but that he ſent to the duke of Bedford to ſolicit his return to England, to ſettle all thoſe differences which were ſo prejudicial to the peace of the kingdom: That though he had indeed written in the letter, ‘That if he tarried, we ſhould put the land in adventure by a field, ſuch a brother you have here,’ he did not mean it of any deſign of his own, but concerning the ſeditious aſſemblies of maſons, carpenters, tylers, and plaiſterers; who being diſtreſſed by the late act of parliament againſt the exceſſive wages of theſe trades, had given out many ſeditious ſpeeches and menaces againſt certain great men, which tended much to rebellion.” &c.

Notwithstanding this heavy charge, the duke of Glouceſter, who knew the innocence of the parties accuſed, took the maſons under his protection, and transferred the charge of ſedition and rebellion from them to the biſhop and his followers. By the intereſt of the latter, however, the king granted him a pardon for all offences; and though the duke drew up freſh articles of impeachment againſt him in 1442, and preſented them in perſon to the king, the council, being

compoſed

Masonry. composed mostly of ecclesiastics, proceeded so slowly in the business, that the duke, wearied out with the tediousness of the matter, dropped the prosecution entirely.

This contest terminated in the impeachment, imprisonment, and murder of the duke of Gloucester himself. This event might have been attended with bad consequence, had not their inveterate enemy, the prelate himself, been taken off by death in about two months after the duke. The masons then continued not only to meet in safety, but were joined by the king himself. He was, that very year (1442) initiated into masonry, and from that time spared no pains to become completely master of the art. He perused the ancient charges, revised the constitutions, and, with the consent of his council, honoured them with his sanction. The example of the sovereign was followed by many of the nobility, who assiduously studied the art. The king presided over the lodges in person, nominating William Wanefleet bishop of Winchester grand-master. This bishop at his own expence built Magdalene college, Oxford, and several religious houses. Eton-college near Windsor, and King's-college at Cambridge, were also founded during this reign. Henry himself founded Christ's-college, Cambridge, as his queen Margaret of Anjou did Queen's-college in the same university.

About this time also, the masons were protected and encouraged by James I. of Scotland, who, after his return from captivity, became a zealous patron of arts and learning of all kinds. He honoured the lodges with his royal presence, and settled an annual revenue of four pounds Scots (an English noble) to be paid by every master-mason in Scotland, to a grand-master chosen by the grand-lodge, and approved by the crown, one nobly born, or an eminent clergyman who had his deputies in cities and counties: something was likewise paid him by every new brother at his entry. His office intitled him to regulate every thing in the fraternity which could not come under the jurisdiction of law-courts; and, to prevent law-suits, both mason and lord, or builder and founder, appealed to him. In his absence, they appealed to his deputy or grand-warden, who resided next the premises.

The flourishing state of masonry was interrupted by the civil wars between the houses of York and Lancaster, which brought it almost totally into neglect. About 1471, however, it revived under the auspices of Robert Beauchamp bishop of Sarum, who had been appointed grand-master by Edward IV. and honoured with the title of *Chancellor of the Garter*, for repairing the castle and chapel of Windsor. It again declined during the reigns of Edward V. and Richard III.; but came once more into repute on the accession of Henry VII. in 1485. It was now patronised by the master and fellows of the order of St John at Rhodes (now Malta); who assembled their grand-lodge in 1500, and chose Henry for their protector. On the 24th of June 1502, a lodge of masters was formed in the palace, at which the king presided as grand-master; and having appointed John Islip abbot of Westminster, and Sir Reginald Bray knight of the garter, his wardens for the occasion, proceeded in great state to the east end of Westminster abbey,

where he laid the first stone of that excellent piece of Gothic architecture called *Henry the Seventh's Chapel*. The cape-stone of this building was celebrated in 1507. The palace of Richmond, as well as many other noble structures, were raised under the direction of Sir Reginald Bray; and the colleges of Brazen-Nose in Oxford, and Jesus and St John's in Cambridge, were all finished in this reign.

On the accession of Henry VIII. Cardinal Wolsey was appointed grand-master; who built Hampton-court, Whitehall, Christ-church college, Oxford, with several other noble edifices; all of which, upon the disgrace of that prelate, were forfeited to the crown in 1530: Wolsey was succeeded as grand-master in 1534 by Thomas Cromwell earl of Essex; who employed the fraternity in building St James's palace, Christ's hospital, and Greenwich castle. Cromwell being beheaded in 1540, John Touchet lord Audley succeeded to the office of grand-master, and built Magdalen college in Cambridge, and many other structures. In 1547, the duke of Somerset, guardian to the king, and regent of the kingdom, became superintendant of the masons, and built Somerset-house in the Strand; which, on his being beheaded, was forfeited to the crown in 1552.

After the death of the duke of Somerset, John Poynter bishop of Winchester presided over the lodges till the death of the king in 1553. From this time they continued without any patron till the reign of Elizabeth, when Sir Thomas Sackville accepted of the office of grand-master. Lodges, however, had been held during this period in different parts of England; but the general or grand lodge assembled in the city of York, where it is said the fraternity were numerous and respectable.—Of the queen we have the following curious anecdote with regard to the masons: Hearing that they were in possession of many secrets which they refused to disclose, and being naturally jealous of all secret assemblies, she sent an armed force to York to break up their annual grand-lodge. The design was prevented by the interposition of Sir Thomas Sackville, who took care to initiate some of the chief officers whom she had sent on this duty in the secrets of masonry. These joined in communication with their new brethren, and made so favourable a report to the queen on their return, that she countermanded her orders, and never afterwards attempted to disturb the meeting of the fraternity. In 1567, Sir Thomas Sackville resigned the office of grand-master in favour of Francis Russel earl of Bedford, and Sir Thomas Gresham an eminent merchant. The former had the care of the brethren in the northern part of the kingdom assigned to him, while the latter was appointed to superintend the meetings in the south, where the society had considerably increased, in consequence of the honourable report which had been made to the queen. The general assembly, however, continued to meet at York as formerly; and here all records were kept, and appeals made on every important occasion to the assembly.

Sir Thomas Gresham abovementioned proposed to erect a building in the city of London for the benefit of commerce, provided the citizens would purchase a spot proper for the purpose. Accordingly some

houses

Masonry.

Masonry houses between Cornhill and Threadneedle-street being pulled down, the foundation-stone of the building was laid on the 7th of June 1566, and with such expedition was the work carried on, that the whole was finished in November 1567. This building, which was constructed on the plan of the exchange of Antwerp, was called at first simply *the Bourfe*, but in January 1570, the queen having dined with Sir Thomas, returned through Cornhill, entered the Bourfe on the south side, and having viewed every part of the building, particularly the gallery which extended round the whole structure, and which was furnished with shops filled with all sorts of the finest merchandize in the city, she caused the edifice to be proclaimed, in her presence, by herald and trumpet, the *Royal Exchange*; and on this occasion, it is said Sir Thomas appeared publicly in the character of grand-master.

The queen being now thoroughly convinced that the fraternity of masons did not interfere in state affairs, became quite reconciled to their assemblies, and from this time masonry made a considerable progress; lodges were held in different parts of the kingdom, particularly in London and its neighbourhood, where the number of the brethren increased considerably. Several great works were carried on there under the auspices of Sir Thomas Gresham, from whom the fraternity received every encouragement.

Sir Thomas was succeeded in the office of grand-master by Charles Howard earl of Effingham, who continued to preside over the lodges in the fourth till the year 1588, when George Hastings earl of Huntingdon was chosen grand-master, and remained in the office till the decease of the queen in 1603.

On the accession of James I. to the crown of England, masonry flourished in both kingdoms, and lodges were held in both kingdoms. A number of gentlemen returned from their travels, with curious drawings of the old Greek and Roman architecture, as well as strong inclination to revive a knowledge of it. Among these was the celebrated Inigo Jones, who was appointed general surveyor to the king. He was named grand-master of England, and was deputed by the king to preside over the lodges (A). Several learned men were now initiated into the mysteries of masonry, and the society increased considerably in reputation and consequence. Ingenious artists resorted to England in great numbers; lodges were constituted as seminaries of instruction in the sciences and polite arts after the model of the Italian schools; the communications of the fraternity were established, and the annual festivals regularly observed. Under the direction of this accomplished architect, many magnificent structures were raised; and among the rest he was employed, by command of the sovereign, to plan a new palace at Whitehall, worthy of the residence of the kings of England. This was executed; but for want of a parliamentary fund, no more of the plan was ever finished than the banqueting-house. Inigo Jones continued in the office of grand-master till the year 1618, when he was succeeded by the earl of Pembroke; under whose auspices many eminent and weal-

thy men were initiated, and the mysteries of the order held in high estimation.

After Charles I. ascended the throne, Earl Pembroke was continued in his office till the year 1630, when he resigned in favour of Henry Danvers earl of Danby. This nobleman was succeeded in 1633 by Thomas Howard earl of Arundel, the ancestor of the Norfolk family. In 1633, Francis Russell earl of Bedford accepted the government of the society; but Inigo Jones having continued to patronize the lodges during his lordship's administration, he was re-elected the following year, and continued in office till the year of his death, 1646. The progress of masonry, however, was for some time obstructed by the breaking out of the civil wars; but it began to revive under the patronage of Charles II. who had been received into the order during his exile. Some lodges during this reign were constituted by leave of the several noble grand-masters, and many gentlemen and famous scholars requested at that time to be admitted into the fraternity. On the 27th of December 1603, a general assembly was held, where Henry Jennyn earl of St Alban's was elected grand-master; who appointed Sir John Denham his deputy, and Mr Christopher Wren, afterwards the celebrated Sir Christopher Wren, and John Webb, his wardens. At this assembly several useful regulations were made, for the better government of the lodges; and the greatest harmony prevailed among the whole fraternity. The earl of St Alban's was succeeded in his office of grand-master by earl Rivers in the year 1666, when Sir Christopher Wren was appointed deputy, and distinguished himself beyond any of his predecessors in promoting the prosperity of the lodges which remained at that time, particularly that of St Paul's, now the lodge of Antiquity, which he patronized upwards of 18 years. At this time he attended the meetings regularly; and during his presidency made a present to the lodge of three mahogany candlesticks, which at that time were very valuable. They are still preserved, and highly valued as a testimony of the esteem of the donor.

The fire which in 1666 destroyed such a great part of London, afforded ample opportunity for the masons to exert their abilities. After a calamity so sudden and extensive, however, it became necessary to adopt some regulations to prevent such a catastrophe in time to come. It was now determined, that in all the new buildings to be erected, stone should be used instead of timber. Wren was ordered by the king and grand-master to draw up the plan of a city with broad and regular streets. Dr Christopher Wren was appointed surveyor-general and principal architect for rebuilding the city, the cathedral of St Paul, and all the parochial churches enacted by parliament, in lieu of those that were destroyed, with other public structures. This gentleman, however, conceiving the charge to be too important for a single person, selected for his assistant Mr Robert Hook professor of geometry in Gresham college. The latter was immediately employed in measuring, adjusting, and setting out the ground.

(A) Mr Preston observes, that the grand-master of the north bears the title of *grand-master of all England*, which (says he) may probably have been occasioned by the title of *grand-master*.

Masonry.

ground of the private streets to the several proprietors. The model and plan were laid before the king and house of commons, and the practicability of the whole scheme, without any infringement of private property: but unfortunately it happened, that the greater part of the citizens were totally averse to leaving their old habitations, and building houses in other places; and so obdurate were they in their determinations, that they chose rather to have their old city again under all its disadvantages, than a new one upon the improved plan. Thus an opportunity was lost of making the new city the most magnificent as well as the most convenient for health and commerce of any in Europe. Hence the architect, being cramped in the execution of his plan, was obliged to alter and abridge it, and to model the city after the manner in which it has since appeared.—In 1673 the foundation-stone of the cathedral of St Paul's was laid with great solemnity by the king in person, and the mallet which he used on this occasion is still preserved in the lodge of Antiquity as a great curiosity.

During the time that the city was rebuilding, lodges were held by the fraternity in different places, and many new ones constituted, to which the best architects resorted. In 1674, earl Rivers resigned the office of grand-master in favour of George Villiers duke of Buckingham, who left the care of the fraternity to his wardens, and Sir Christopher Wren who still continued to act as deputy. In 1679, the duke resigned in favour of Henry Bennet earl of Arlington; but this nobleman was too deeply engaged in state affairs to attend to his duty as a mason, though the lodges continued to meet under his sanction, and many respectable gentlemen joined the fraternity. During the short reign of James II. the masons were much neglected. In 1685, Sir Christopher Wren was elected to the office of grand-master, who appointed Gabriel Cibber and Mr Edward Strong his wardens: yet notwithstanding the great reputation and abilities of this celebrated architect, masonry continued in a declining way for many years, and only a few lodges were held occasionally in different parts of the kingdom.

At the Revolution, the society was in such a low state in the south of England, that only seven regular lodges were held in London and its suburbs; and of these only two, viz. that of St Paul's and one at St Thomas's hospital, Southwark, were of any consequence. But in 1695 king William having been initiated into the mysteries, honoured the lodges with his presence, particularly one at Hampton-court, at which he is said to have frequently presided during the time that the new part of his palace was building. Many of the nobility also were present at a general assembly and feast held in 1697, particularly Charles duke of Richmond and Lenox, who was elected grand-master for that year; but in 1698 resigned his office to Sir Christopher Wren, who continued at the head of the fraternity till King William's death in 1702.

During the reign of Queen Anne, masonry made no considerable progress. Sir Christopher's age and infirmities drew off his attention from the duties of his office, the annual festivals were entirely neglected, and the number of masons considerably diminished. It was therefore determined that the privileges of ma-

sonry not be confined to operative masons, but that people of all professions should be admitted to participate in them, provided they were regularly approved and initiated into the order.

Masonry.

Thus the society once more rose into esteem; and on the accession of George I. the masons, now deprived of Sir Christopher Wren, resolved to unite again under a grand-master, and revive the annual festivals. With this view, the members of the only four lodges at that time existing in London, met at the Apple-tree tavern in Charles-street, Covent Garden; and having voted the oldest master-mason then present into the chair, constituted themselves a grand-lodge *pro tempore*. It was now resolved to renew the quarterly communications among the brethren; and at an annual meeting held on the 24th of June the same year, Mr Anthony Sayer was elected grand-master, invested by the oldest master-mason then present, installed by the master of the oldest lodge, and had due homage paid him by the fraternity. Before this time a sufficient number of masons, met together within a certain district, had ample power to make masons without a warrant of constitution; but it was now determined, that the privilege of assembling as masons should be vested in certain lodges or assemblies of masons convened in certain places, and that every lodge to be afterwards convened, excepting the four old lodges then existing, should be authorized to act by a warrant from the grand-master for the time, granted by petition from certain individuals, with the consent and approbation of the grand-lodge in communication; and that without such warrant, no lodge should hereafter be deemed regular or constitutional. The former privileges, however, were still allowed to remain to the four old lodges then extant. In consequence of this, the old masons in the metropolis vested all their inherent privileges as individuals in the four old lodges, in trust that they never would suffer the ancient charges and land-marks to be infringed. The four old lodges, on their part, agreed to extend their patronage to every new lodge which should hereafter be constituted according to the new regulations of the society; and while they acted in conformity to the ancient constitutions of the order, to admit their masters and wardens to share with them all the privileges of the grand-lodge, that of precedence only excepted.

Matters being thus settled, the brethren of the four old lodges considered their attendance on the future communications of the society as unnecessary; and therefore trusted implicitly to their masters and wardens, satisfied that no measure of importance would be adopted without their approbation. It was, however, soon discovered, that the new lodges being equally represented with the old ones at the communications, would at length so far outnumber them, that by a majority they might subvert the privileges of the original masons of England which had been centered in the four old lodges; on which account a code of laws was, with the consent of the brethren at large, drawn up for the future government of the society. To this the following was annexed, binding the grand-master for the time being, his successors, and the master of every lodge to be hereafter constituted, to preserve it inviolably; "Every annual grand-lodge has

Masonry.

an inherent power and authority to make new regulations, or to alter these for the real benefit of this ancient fraternity, provided always that the old landmarks be carefully preserved: and that such alterations and new regulations be proposed and agreed to at the third quarterly communication preceding the annual grand feast; and that they be offered also to the perusal of all the brethren before dinner, in writing, even of the youngest apprentice; the approbation and consent of the majority of all the brethren present being absolutely necessary to make the same binding and obligatory." To commemorate this circumstance, it has been customary, ever since that time, for the master of the oldest lodge to attend every grand installation; and, taking precedence of all present, the grand-master only excepted, to deliver the book of the original constitutions to the new installed grand-master, on his promising obedience to the ancient charges and general regulations.

By this precaution the original constitutions were established as the basis of all succeeding masonic jurisdiction in the south of England; and the ancient *landmarks*, as they are called, or the boundaries set up as checks against innovation, were carefully secured from the attacks of any future invaders. No great progress, however, was made during the administration of Mr Sayer, only two lodges being constituted, though several brethren joined the old ones. In 1718 Mr Sayer was succeeded by Mr George Payne, who collected many valuable manuscripts on the subject of masonry, and earnestly requested, that the fraternity would bring to the grand lodge any old writings or records concerning the fraternity, to show the usages of ancient times: and in consequence of this invitation, several old copies of the Gothic constitutions were produced, arranged, and digested. Another assembly and feast were held on the 24th of June 1719, when Dr Desaguliers, was unanimously elected grand-master. At this feast the old, regular, and peculiar toasts were introduced; and from this time we may date the rise of free-masonry on its present plan in the south of England. Many new lodges were established, the old ones visited by many masons who had long neglected the craft, and several noblemen initiated into the mysteries. In 1720, however, the fraternity sustained an irreparable loss by the burning of several valuable manuscripts, concerning the lodges, regulations, charges, secrets, &c. (particularly one written by Mr Nicholas Stone, the warden under Inigo Jones). This was done by some scrupulous brethren, who were alarmed at the publication of the masonic constitutions. At a quarterly communication it was this year agreed, that, for the future, the new grand-master shall be named and proposed to the grand lodge some time before the feast; and if approved and present, he shall be saluted as grand-master elect: and that every grand-master, when he is installed, shall have the sole power of appointing his deputy and wardens according to ancient custom.

In the mean time masonry continued to spread in the north as well as the south of England. The general assembly, or grand lodge at York, continued to meet as usual. Several lodges met in 1705, under the direction of Sir John Tempest baronet, then grand-master; and many persons of worth and character were

Masonry.

initiated into the mysteries of the fraternity. The greatest harmony subsisted between the two grand lodges, and private lodges were formed in both parts of the kingdom under their separate jurisdiction. The only distinction which the grand lodge in the north appears to have retained is in the title of the *Grand Lodge of all England*; while the other was only called the *Grand Lodge of England*. The latter, however, being encouraged by some of the principal nobility, soon acquired consequence and reputation, while the other seemed gradually to decline; but, till within these few years, the authority of the grand lodge at York was never challenged; on the other hand, every mason in the kingdom held that assembly in the highest veneration, and considered himself bound by the charges which originated from that assembly. It was the glory and boast of the brethren in almost every country where masonry was established to be accounted descendants of the original York masons; and from the universality of the idea that masonry was first established at York by charter, the masons of England have received tribute from the first states in Europe. At present, however, this social intercourse is abolished, and the lodges in the north and south are almost entirely unknown to one another; and neither the lodges of Scotland nor Ireland court the correspondence of the grand lodge at London. This is said to have been owing to the introduction of some innovations among the lodges in the south; but for the coolness which subsists between the two grand lodges another reason is assigned. A few brethren at York having, on some trivial occasion, seceded from their ancient lodge, they applied to London for a warrant of constitution. Their application was honoured without any inquiry into the merits of the case; and thus, instead of being recommended to the mother-lodge to be restored to favour, these brethren were encouraged to revolt, and permitted, under the sanction of the grand lodge in London, to open a new lodge in the city of York itself. This illegal extension of power justly offended the grand lodge at York, and occasioned a breach which has never yet been made up.

The duke of Buccleugh, who in 1723 succeeded the duke of Wharton as grand-master, first proposed the scheme of raising a general fund for distressed masons. The duke's motion was supported by Lord Paisley, Colonel Houghton, and a few other brethren; and the grand lodge appointed a committee to consider of the most effectual means of carrying the scheme into execution. The disposal of the charity was first vested in seven brethren; but this number being found too small, nine more were added. It was afterwards resolved that 12 masters of contributing lodges, in rotation with the grand officers, should form the committee; and by another regulation since made, it has been determined that all past and present grand officers, with the masters of all regular lodges which shall have contributed within 12 months to the charity, shall be members of the committee. This committee meets four times in the year by virtue of a summons from the grand master or his deputy. The petitions of the distressed brethren are considered at these meetings; and if the petitioner be considered as a deserving object, he is immediately relieved with five pounds. If the circumstances of the case are of

Masonry.

a peculiar nature, his petition is referred to the next communication, where he is relieved with any sum the committee may have specified, not exceeding 20 guineas at one time. Thus the distressed have always found ready relief from this general charity, which is supported by the voluntary contributions of different lodges out of their private funds, without being burdensome to any member in the society. Thus has the committee of charity for free masons been established; and so liberally have the contributions been, that though the sums annually expended for the relief of the distressed brethren have for several years past amounted to many thousand pounds, there still remains a considerable sum.

The most remarkable events which of late have taken place in the affairs of masonry, are the initiation of Omilul-Omrâh Bahauder, eldest son of the nabob of the Carnatic, who was received by the lodge of Trinchinopoly in the year 1779. The news being officially transmitted to England, the grand lodge determined to send a congratulatory letter to his highness on the occasion, accompanied with an apron elegantly decorated, and a copy of the book of Constitutions superbly bound. The execution of this commission was entrusted to Sir John Dwy, advocate-general of Bengal; and in the beginning of 1780, an answer was received from his highness, acknowledging the receipt of the present, and expressing the warmest attachment and benevolence to his brethren in England. The letter was written in the Persian language, and inclosed in an elegant cover of cloth of gold, and addressed to the grand-master and grand lodge of England. A proper reply was made; and a translation of his highness's letter was ordered to be copied on vellum; and, with the original, elegantly framed and glazed, and hung up in the hall at every public meeting of the society.

After such a long history of the rise and progress of masonry, it must be natural to inquire into the uses of the institution, and for what purpose it has been patronised by so many great and illustrious personages. The profound secrecy, however, in which every thing relating to masonry is involved, prevents us from being very particular on this head. The masons themselves say, in general, that it promotes philanthropy, friendship, and morality; that in proportion as masonry has been cultivated, the countries have been civilized, &c. How far this can be depended upon, the fraternity themselves best know. Another advantage, however, seems less equivocal, viz. that its signs serve as a kind of universal language, so that by means of them people of the most distant nations may become acquainted, and enter into friendship with one another. This certainly must be accounted a very important circumstance; and considering the great number which have been, and daily are, admitted to the society, and their inviolable attachment to the art, we must certainly conclude, that if it contains nothing of great importance to mankind at large, it must at least be extremely agreeable, and even fascinating to those who are once initiated.

Egyptian Masonry, a new system of masonry taught by the celebrated impostor the Count Cagliostro.—It is not known whether this system was an invention of his own, or whether any such thing really has an

existence among the superstitious Egyptians. The scheme was first put in execution in London; and by means of his pretended knowledge in the mysteries of this art, the Count procured great sums of money, and attached to himself a vast number of followers. The following particulars concerning it were confessed by him before the inquisition at Rome.

The Egyptian masons are divided into several sects, but there are two more esteemed than the rest. The first is that of the adepts, the members of which (say the inquisitors) profess the most irreligious sentiments, and employ magic in their operations; but their principal object is the destruction of the Catholic religion and of monarchy. The members of the other pretend to be occupied about the secrets of the hermetic art, and more especially the philosopher's stone. Cagliostro owned that he was associated in London with the second of these sects; that his wife was likewise a member, and received a diploma, which cost five guineas. The lady was presented with a ribbon, on which were embroidered the words *Union, Silence, and Virtue*; and she was desired to sleep the following night with the ribbon attached to her thigh. When a male candidate is to be admitted, his courage must be tried in a number of ways. Cagliostro himself submitted to these trials; among which the following are mentioned in the account of his life. He was first hoisted up to the cindling by means of a pulley, and, after suffering considerable pain, had his hand scorched by means of a candle. His eyes were then covered with a bandage, and he received an empty pistol, with orders to charge it. This being done, he was ordered to discharge it against his head; and upon his refusing to do so, the pistol was taken from him with contempt, but returned after a number of ceremonies. This had such an effect upon him, that without any regard to self-preservation, he drew the trigger, and got a smart stroke on the skull, which, however, produced no bad consequence. At the initiation of other candidates, he discovered that the pistol was changed, an unloaded one being put into the hands of the person when blind-folded, and that one of the assistants struck him a smart blow on the head, to make him think himself wounded. The ceremony was concluded with his taking an oath of secrecy and obedience to the grand-master.

MASORA, a term in the Jewish theology, signifying a work on the Bible, performed by several learned rabbins, to secure it from any alterations which might otherwise happen.

Their work regards merely the letter of the Hebrew text, in which they have, first, fixed the true reading by vowels and accents: they have, secondly, numbered not only the chapters and sections, but the verses, words, and letters of the text: and they find in the Pentateuch 5245 verses, and in the whole Bible 23206. The *mafora* is called, by the Jews, *the hedge or fence of the law*, because this enumeration of the verses, &c. is a means of preserving it from being corrupted and altered. They have, thirdly, marked whatever irregularities occur in any of the letters of the Hebrew text; such as the different size of the letters, their various positions and inversions, &c. and they have been fruitful in finding out reasons for these irregularities and mysteries in them. They are, fourthly, supposed to be

Masonry.
Mafora.

Masora.
Masque.

be the authors of the Keri and Chetibh, or the marginal corrections of the text in our Hebrew Bibles.

The text of the sacred books, it is to be observed, was originally written without any breaks or divisions into chapters or verses, or even into words; so that a whole book, in the ancient manner, was but one continued word; of this kind we have still several ancient manuscripts, both Greek and Latin. In regard, therefore, the sacred writings had undergone an infinite number of alterations, whence various readings had arisen, and the original was become much mangled and disguised, the Jews had recourse to a canon, which they judged infallible, to fix and ascertain the reading of the Hebrew text; and this rule they call *masora*, "tradition," from *tradidit*, as if this critique were nothing but a tradition which they had received from their forefathers. Accordingly they say, that when God gave the law to Moses at Mount Sinai, he taught him, first, the true reading of it; and, secondly, its true interpretation; and that both these were handed down by oral tradition, from generation to generation, till at length they were committed to writing. The former of these, viz. the true reading, is the subject of the *masora*; the latter, or true interpretation, that of the *mishtna* and *gemara*.

According to Elias Levita, they were the Jews of a famous school at Tiberias, about 500 years after Christ, who composed, or at least began, the *masora*; whence they are called *masorites*, and *masoretic doctors*. Aben Ezra makes them the authors of the points and accents in the Hebrew text, as we now find it; and which serve for vowels.

The age of the *masorites* has been much disputed. Archbishop Usher places them before Jerom; Capel, at the end of the fifth century; father Morin, in the tenth century. Bagnage says, that they were not a society, but a succession of men; and that the *masora* is the work of many grammarians, who, without associating and communicating their notions, composed this collection of criticisms on the Hebrew text. It is urged that there were *masorites* from the time of Ezra and the men of the great synagogue, to about the year of Christ 1030; and that Ben Asher and Ben Naphtali, who were the best of the profession, and who, according to Bagnage, were the inventors of the *masora*, flourished at this time. Each of these published a copy of the whole Hebrew text, as correct, says Dr Prideaux, as they could make it. The eastern Jews have followed that of Ben Naphtali, and the western that of Ben Asher; and all that has been done since is to copy after them, without making any more corrections, or *masoretic* criticisms.

The Arabs have done the same thing by their *Koran* that the *masorites* have done by the Bible; nor do the Jews deny their having borrowed this expedient from the Arabs, who first put it in practice in the seventh century.

There is a great and little *masora* printed at Venice and at Basil, with the Hebrew text in a different character. Buxtorf has written a *masoretic* commentary, which he calls *Tiberias*.

MASQUE, or MASK, a cover for the face, contrived with apertures for the eyes and mouth; originally worn chiefly by women of condition, either to preserve their complexion from the weather, or out of

Masque.

modesty to prevent their being known. Poppea, wife of Nero, is said to be the first inventor of the *masque*; which she did to guard her complexion from the sun and weather, as being the most delicate woman, with regard to her person, that has been known.

Theatrical *masques* were in common use both among the Greeks and Romans: Suidas and Athenæus ascribe the invention of them to the poet Choerilus, a contemporary of Thespis; Horace attributes them to Æschylus; but Aristotle informs us, that the real inventor, and consequently the time of their first introduction and use, were unknown. Brantome observes, that the common use of modern *masques* was not introduced till towards the end of the sixteenth century.

MASQUE is also used to signify any thing used to cover the face, and prevent a person's being known. The penitents of Lyons and Avignon hide their faces with large white veils, which serve them for *masques*.

The Iron *Masque* (*Masque de Fer*), or *Man with the iron masque*, a remarkable personage so denominated, who existed as a state prisoner in France during the latter part of the last century. As the circumstances of this person form a historical problem which has occasioned much inquiry, and given rise to many conjectures, as well as of late, in consequence of the destruction of the Bastille, excited in a particular manner the curiosity of the public, it shall be endeavoured to condense in this article the substance of every thing material that has been published on the subject. We shall first relate such particulars concerning this extraordinary prisoner as appear to be well authenticated; and shall afterwards mention the different opinions and conjectures that have been entertained with regard to his real quality, and the causes of his confinement.

I. The authenticated particulars concerning the *iron Masque* are as follows:—A few months after the death of Cardinal Mazarine, there arrived at the isle of Sainte Marguerite, in the sea of Provence, a young prisoner whose appearance was peculiarly attracting; his person was above the middle size, and elegantly formed; his mien and deportment were noble; and his manners graceful; and even the sound of his voice, it is said, had in it something uncommonly interesting. On the road he constantly wore a mask made with iron springs, to enable him to eat without taking it off. It was at first believed that this *masque* was made entirely of iron; whence he acquired the name of "the Man with the iron mask." His attendants had received orders to dispatch him if he attempted to take off his *masque* or discover himself.—He had been first confined at Pigneol, under the care of the governor M. de St Mars; and upon being sent from thence to Sainte Marguerite, he was accompanied thither by the same person, who continued to have the charge of him. He was always treated with the most marked respect: he was served constantly in plate; and the governor himself placed his dishes on the table, retiring immediately after and locking the door behind him. He *tu-to-yoit* (thee'd and thou'd) the governor; who, on the other hand, behaved to him in the most respectful manner, and never wore his hat before him, nor sat down in his presence unless he was desired. The Marquis de Louvois, who went to see him at St Marguerite, spoke to him standing, and with that kind of attention which denotes high respect.

During his residence here, he attempted twice, in an indirect manner, to make himself known. One day he wrote something with his knife on a plate, and threw it out of his window towards a boat that was drawn on shore near the foot of the tower. A fisherman picked it up and carried it to the governor. M. de St Mars was alarmed at the sight; and asked the man with great anxiety, whether he could read, and whether any one else had seen the plate? The man answered, that he could not read, that he had but just found the plate, and that no one else had seen it. He was, however, confined till the governor was well assured of the truth of his assertions.—Another attempt to discover himself proved equally unsuccessful. A young man who lived in the isle, one day perceived something floating under the prisoner's window; and on picking it up, he discovered it to be a very fine shirt written all over. He carried it immediately to the governor; who, having looked at some parts of the writing, asked the lad, with some appearance of anxiety, if he had not had the curiosity to read it? He protested repeatedly that he had not: but two days afterwards he was found dead in his bed.

The *Masque de Fer* remained in this life till the year 1698, when M. St Mars being promoted to the government of the Bastille, conducted his prisoner to that fortress. In his way thither, he stopt with him at his estate near Palteau. The Masque arrived there in a litter, surrounded by a numerous guard on horseback. M. de St Mars sat at the same table with him all the time they resided at Palteau; but the latter was always placed with his back towards the windows; and the peasants, who came to pay their compliments to their master, and whom curiosity kept constantly on the watch, observed that M. de St Mars always sat opposite to him with two pistols by the side of his plate. They were waited on by one servant only, who brought in and carried out the dishes, always carefully shutting the door both in going out and returning. The prisoner was always masked, even when he passed through the court; but the people saw his teeth and lips, and also observed that his hair was grey.—The governor slept in the same room with him, in a second bed that was placed in it on that occasion. In the course of their journey, the iron-mask was, one day, heard to ask his keeper whether the king had any design on his life? “No, Prince,” he replied; “provided that you quietly allow yourself to be conducted, your life is perfectly secure.”

The stranger was accommodated as well as it was possible to be in the Bastille. An apartment had been prepared for him by order of the governor before his arrival, fitted up in the most convenient style; and every thing he expressed a desire for was instantly procured him. His table was the best that could be provided; and he was ordered to be supplied with as rich clothes as he desired: but his chief taste in this last particular was for lace, and for linen remarkably fine. It appears that he was allowed the use of such books as he desired, and that he spent much of his time in reading. He also amused himself with playing upon the guitar. He had the liberty of going to mass; but was then strictly forbid to speak or uncover his face: orders were even given to the soldiers to fire upon

him if he attempted either; and their pieces were always pointed towards him as he passed through the court. When he had occasion to see a surgeon or a physician, he was obliged, under pain of death, constantly to wear his mask. An old physician of the Bastille, who had often attended him when he was indisposed, said, that he never saw his face, though he had frequently examined his tongue, and different parts of his body; that there was something uncommonly interesting in the sound of his voice; and that he never complained of his confinement, nor let fall from him any hint by which it might be guessed who he was. It is said that he often passed the night in walking up and down his room.

This unfortunate prince died on the 19th of November 1703, after a short illness; and was interred next day in the burying-place of the parish of St Paul. The expence of his funeral amounted only to forty livres. The name given him was *Marchiali*: and even his age, as well as his real name, it seemed of importance to conceal; for in the register made of his funeral, it was mentioned that he was about forty years old; though he had told his apothecary, some time before his death, that he thought he must be sixty.—It is a well known fact, that immediately after the prisoner's death, his apparel, linen, clothes, mattresses, and in short every thing that had been used by him, were burnt; that the walls of his room were scraped, the floor taken up, evidently from the apprehension that he might have found means of writing any thing that would have discovered who he was. Nay such was the fear of his having left a letter or any mark which might lead to a discovery, that his plate was melted down; the glass was taken out of the window of his room and pounded to dust; the window-frame and doors burnt; and the ceiling of the room, and the plaster of the inside of the chimney, taken down. Several persons have affirmed, that the body was buried without a head; and Monsieur de Saint Foix informs us, that “a gentleman having bribed the sexton, had the body taken up in the night, and found a stone instead of the head.”

The result of these extraordinary accounts is, that the iron masque was not only a person of high birth, but must have been of great consequence; and that his being concealed was of the utmost importance to the king and ministry. We come now, therefore, to notice,

II. The opinions and conjectures that have been formed concerning the real name and condition of this remarkable personage. Some have pretended that he was the duke of Beaufort; others, that he was the Count de Vermandois, natural son to Louis XIV. by the duchess de la Valliere. Some maintain him to have been the duke of Monmouth, natural son of Charles II. of England by Lucy Walters; and others say, that he was Gerolami Magni, minister to the duke of Modena.

Besides these conjectures, none of which possess sufficient probability to entitle them to consideration, a fifth has been advanced; namely, That the Iron Masque was a son of Anne of Austria, queen to Louis XIII. and consequently that he was a brother of Louis XIV.; but whether a bastard brother, a bro-

† In his *Essai sur l'Histoire*.

Masque.

ther-german, or a half brother, is a question that has given rise to three several opinions; which we shall state in the order of time in which the respective transactions to which they allude happened.

1. The first opinion is, that the queen proved with child at a time when it was evident it could not have been by her husband, who, for some months before, had never been with her in private. The supposed father of this child is said by some to have been the duke of Buckingham, who came to France in May 1625, to conduct the princess Henrietta, wife of Charles I. to England. The private letters and memoirs of those times speak very suspiciously of the queen and Buckingham: his behaviour at Amiens, whither the queen and queen-mother accompanied the princess in her way to Boulogne, occasioned much whispering; notwithstanding the pains that have been taken by La Porte in his *Mémoires* to excuse his mistress, it appears that the king, on this occasion, was extremely offended at her, and that it required all the influence and address of the queen-mother to effect a reconciliation. It is said, that this child was privately brought up in the country; that when Mazarin became a favourite, he was entrusted with the care of him; and that Louis XIV. having discovered the secret on the death of the cardinal, thought it necessary to confine him in the manner that has been related.

Hist. of the
Bastille, n° 6.
P. 343.

But it may be observed, that this secret could scarcely have escaped the vigilance of the cardinal de Richlieu; and it is not improbable, that a minister so little scrupulous, if inclined to save the honour of a queen, would have removed a child, who, if he lived, might have been made use of to disturb the tranquillity of the kingdom. After this supposed birth, the queen had frequent quarrels with the king, and, what was more dangerous, with the cardinal; who even used every means in his power to enquire into her most private transactions. It was on a memorable occasion of this kind, that her servant La Porte was thrown into the Bastille; and it can scarcely be imagined the would have had the firmness she then displayed, while conscious of so much guilt, and under the risk of having it discovered. The prisoner with the masque appears, by several accounts, to have been a youth of a handsome figure in the year 1661; and in 1703, when he died, to have been above sixty; but had he been a son of Buckingham, he would have been about thirty-six in 1661, when he could not be said to have been a youth; and in November 1703, above seventy-eight.

2. The second opinion is, that he was the twin-brother of Louis XIV. born some hours after him. This first appeared in a short anonymous work published without date, and without the name of place or printer. It is therein said, "Louis XIV. was born at St Germain en Laye, on the 5th of September 1638, about noon; and the illustrious prisoner, known by the appellation of the *Iron masque*, was born the same day, while Louis XIII. was at supper. The king and the cardinal, fearing that the pretensions of a

twin brother might one day be employed to renew those civil wars with which France had been so often afflicted, cautiously concealed his birth, and sent him away to be brought up privately. Having but an imperfect knowledge of the circumstances that followed, I shall say nothing more, for fear of committing errors; but I firmly believe the fact I have mentioned; and time will probably prove to my reader, that I have ground for what I have advanced."

Masque.

This opinion has been more noticed since the publication of a work called *Mémoires du Marechal Duc de Richlieu*, written by the Abbé Soulavie; concerning which it may be proper to premise, that the present duke of Richlieu, son of the marechal, disavows this work; while the Abbé Soulavie, who had been employed by the marechal, insists on the authenticity of his papers (A). He informs us, that the duke of Richlieu was the lover of Mademoiselle de Valois, daughter of the regent duke of Orleans, and afterwards duchess of Modena, who in return was passionately fond of him: that the regent had something more than a paternal affection for his daughter; and that, though he held his sentiments in abhorrence, the duke of Richlieu made use of her influence with her father to discover the secret of the prisoner with the masque: that the regent, who had always observed the most profound silence on this subject, was at last persuaded to entrust her with a manuscript, which she immediately sent to her lover, who took a copy of it. This manuscript is supposed to have been written by a gentleman on his death-bed, who had been the governor of the prisoner. The following is an extract of it, from what the Abbé Soulavie has told us.

"The birth of the prisoner happened in the evening of the 5th of September 1638, in presence of the chancellor, the bishop of Meaux, the author of the manuscript, a midwife named Peronette, and a few Honorat. This circumstance greatly disturbed the king's mind; he observed, that the Salique law had made no provision for such a case; and that it was even the opinion of some, that the last born was the first conceived, and therefore had a prior right to the other. By the advice of cardinal de Richlieu, it was therefore resolved to conceal his birth, but to preserve his life, in case by the death of his brother it should be necessary to avow him. A declaration was drawn up, and signed and sworn to by all present, in which every circumstance was mentioned, and several marks on his body described. This document being sealed by the chancellor with the royal seal, was delivered to the king; and all were commanded and took an oath never to speak on the subject, not even in private and among themselves. The child was delivered to the care of Madame Peronette the midwife, to be under the direction of cardinal de Richlieu, at whose death the charge devolved to cardinal de Mazarin. Mazarin appointed the author of the manuscript his governor, and entrusted to him the care of his education. But as the prisoner was extremely attached to Madame Peronette, and she equally so to him, she remained with him till her death. His governor carried him to his house in Burgundy,

(A) A letter from the duke of Richlieu, and an answer from the Abbé Soulavie, appeared in the Journal de Paris.

Masque.

gundy, where he paid the greatest attention to his education.

"As the prisoner grew up, he became impatient to discover his birth, and often importuned his governor on that subject. His curiosity had been roused, by observing that messengers from the court frequently arrived at the house; and a box, containing letters from the queen and the cardinal, having one day been inadvertently left out, he opened it, and saw enough to guess at the secret. From that time he became thoughtful and melancholy, 'which (says the author) I could not then account for. He shortly after asked me to get him a portrait of the late and present king, but I put him off by saying that I could not procure any that were good.' He then desired me to let him go to Dijon; which I have known since was with an intention of seeing a portrait of the king there, and of going secretly to St John de Lus, where the court then was on occasion of the marriage with the infant. He was beautiful; and love helped him to accomplish his wishes. He had captivated the affections of a young housekeeper, who procured him a portrait of the king. It might have served for either of the brothers; and the discovery put him into so violent a passion, that he immediately came to me with the portrait in his hand, saying, *Voilà mon frere, et voilà qui je suis*, showing me at the same time a letter of the cardinal de Mazarin that he had taken out of the box.' Upon this discovery his governor immediately sent an express to court to communicate what had happened, and to desire new instructions; the consequence of which was, that the governor and the young prince under his care were arrested and confined."

This memoir, real or fictitious, concludes with saying, "I have suffered with him in our common prison; I am now summoned to appear before my Judge on high; and for the peace of my soul I cannot but make this declaration, which may point out to him the means of freeing himself from his present ignominious situation, in case the king his brother should die without children. Can an extorted oath compel me to observe secrecy on a thing so incredible, but which ought to be left on record to posterity."

3. The third opinion is, that he was a son of the queen by the cardinal de Mazarin, born about a year after the death of her husband Louis XIII.; that he was brought up secretly; and that soon after the death of the cardinal, which happened on the 9th of March 1661, he was sent to Pignerol. To this account Father Griffet* objects, "that it was needless to masque a face that was unknown; and therefore that this opinion does not merit discussion." But in answer it has been observed, That the prisoner might strongly resemble Louis XIV. which would be a sufficient reason to have him masked. This opinion is supposed to have been that entertained by Voltaire, who asserts his thorough knowledge of the secret, though he declined being altogether explicit. The Abbé Soulavie, author of *Memoirs of the Marechal de Richlieu*, speaking on this subject, says, "That he once observed to the Marechal, that he certainly had the means of being informed who the prisoner was; that it even seemed that he had told Voltaire, who durst not venture to publish the secret; and that he at last asked him, whether he was not the elder brother of Louis XIV. born without

the knowledge of Louis the XIII.? That the marechal seemed embarrassed, but afterwards said, that he was neither the ballard brother of Louis the XIV. nor the duke of Monmouth, nor the count of Vermandois, nor the duke of Beaufort, as different authors had advanced; that their conjectures were nothing but reveries; but added, that they however had related many circumstances that were true; that in fact the order was given to put the prisoner to death if he discovered himself; and that he finished the conversation by saying, All I can tell you on the subject is, that the prisoner was not of such consequence when he died at the beginning of the present century as he had been at the beginning of the reign of Louis the XIV. and that he was shut up for important reasons of state." The Abbé Soulavie tells us, that he wrote down what had been said, and gave it to the Marechal to read, who corrected some expressions. The Abbé having proposed some further questions, he answered, "Read what Voltaire published last on the subject of the prisoner with the masque, especially at the end, and reflect on it."—The passage of Voltaire alluded to is as follows.

"The man with the masque (says he) is an enigma of which every one would guess the meaning. Some have said that it was the duke of Beaufort; but the duke of Beaufort was killed by the Turks in the defence of Candy in 1669, and the prisoner with the masque was at Pignerol in 1661. Besides, how could the duke of Beaufort have been arrested in the midst of his army, and brought to France, without any one knowing it? and why confine him? and why that mask?—Others have dreamed that he was the count de Vermandois, natural son of Louis XIV. who died publicly at the army in 1683 of the small-pox, and was buried at the little town of Aire and not Arras; in which Father Griffet was mistaken, but in which to be sure there is no great harm.—Others have imagined, that it was the duke of Monmouth, who was beheaded publicly in London in the year 1685. But for this he must have risen again from the dead, and he must have changed the order of time, and placed the year 1662 in the room of the year 1685. King James, who never forgave any one, and who on that account deserved all that happened to him, must have pardoned the duke of Monmouth, and got another to die in his stead, who perfectly resembled him. This Sofia must first have been found, and then he must have had the goodness to let his head be cut off in public, to save the duke of Monmouth. It was necessary that all England should be mistaken; and that King James should beg of Louis XIV. to be so obliging as to be his gaoler; that Louis XIV. after having shown this trifling piece of civility to King James, should not have been wanting in the same attention to his friend King William and to Queen Anne (with both of whom he was engaged in war), and to please them, retained the dignity of gaoler, with which James had honoured him.

"All these illusions being dissipated, it then remains to know who this prisoner was, and at what age he died. It is clear, that if he was not permitted to cross the court of the Bastille, or to speak to his physician, except covered with a masque, it must have been from the apprehension that his features and countenance

* *Traité de la Verité de l'Histoire*, p. 318. n.

Masque.

nance might have discovered some resemblance. He could show his tongue, but not his face. He said himself to the apothecary of the Bastille, a few days before his death, that he believed he was about 60. Mr Marsoban, who was son-in-law to this apothecary, and surgeon to the marshal de Richlieu, and afterwards to the regent duke of Orleans, told me this frequently. Why give him an *ITALIAN* name!—They always called him *Marchiali*. He who writes this article perhaps knows more than Father Griffet, but he will say nothing farther."

This opinion has been lately resumed, illustrated, and enforced, by M. de Saint Mihiel, in a work intitled *Le Vritable Homme*, &c. "The real Man with the Iron Masque." The author, in support of his idea, attempts to prove that Anne of Austria and Cardinal Mazarine were married. This, says he, the duchess of Orleans assures us of in three of her letters. In the first, dated Sept. 13. 1713, she expresses herself as follows: "Old Beauvais, who was first lady of the bed-chamber to the queen-dowager, was acquainted with the secret of the ridiculous marriage; this rendered it necessary for the queen to do every thing that her confidant wished; and this circumstance has given rise in this country to an extension of the rights of first ladies of the bedchamber." In the second of these letters, dated Nov. 2. 1717, she says, "The queen-mother, widow of Louis XIII. did worse than love Cardinal Mazarine; he married him, for he was not a priest: he was not even in orders; and who could have hindered her? He was most horribly tired of the good queen-mother, and lived on very bad terms with her, which is the reward that people deserve for entering into such marriages." In her third letter, dated July 2. 1719, speaking of the queen, the duchess says, "She was perfectly easy respecting Cardinal Mazarine; he was not a priest, and therefore nothing could prevent their being married. The secret passage through which the Cardinal went every evening to the queen's apartment is still to be seen at the Palais-Royal." Among other proofs besides the above, which M. de St Mihiel brings to substantiate this marriage, he observes, that Mazarine held all councils of state in his apartment whilst he was shaving or dressing; that he never permitted any person to sit down in his presence, not even the chancellor nor marshal de Villeroi; and that while they were deliberating with him on state affairs he would be often playing with his monkey or linnet. What man (continues the author) would have subjected to such humiliations a chancellor, who holds the first office in the kingdom since that of constable has been suppressed, and a marshal who was governor to the king, had he not been in reality a sovereign himself, in virtue of his being husband to the queen-regent? He therefore concludes, that the man with the iron masque was son to Anne of Austria and Cardinal Mazarine; and endeavours to justify this assertion by a variety of conjectural proofs. Of some of these we shall give a short sketch:

1. No prince, or person of any consideration, after the year 1644, at which time the man with the iron masque was born, until the time when his existence was known, disappeared in France. This personage, therefore, was not a prince or great lord of France known at that time.

Masque.

2. The man with the iron masque was not a foreigner; for foreigners, even of the highest distinction, did not at that period study the French language in such a manner as to attain so great perfection in it as to pass for Frenchmen. If this prisoner had spoken with the least foreign accent, the officers, physicians, surgeons, apothecaries, confessors, and others employed in the prisons where he was, and especially the prisoners with whom he conversed at St Margaret, would not have failed to discover it. From all this M. de St Mihiel infers that he must have been a Frenchman.

3. The existence of the man with the iron masque has been known for upwards of 90 years. Had any person of high rank disappeared at an anterior period, his friends, relations, or acquaintances, would not have failed to claim him, or at least to suppose that he was the man concealed by this masque. But no one disappeared, nor was any one claimed: the man with the iron masque was therefore a person unknown.

4. This man was not torn away from society on account of any criminal action; for when he was arrested, it was foreseen that he would cause much embarrassment, and occasion great expences. He was therefore not a criminal, else means would have been pursued to get rid of him; and consequently all the importance of his being concealed was attached solely to his person.

5. This stranger must have been a person of very high birth; for the governor of the prison St Mars behaved always to him with the greatest respect.

6. Louis XIII. played on the guitar; Louis XIV. did the same in a very masterly manner; and the man with the iron masque played also on that instrument: which gives us reason to believe that his education was directed by the same persons who had preided over that of Louis XIV. and who appear to have been the particular choice of Anne of Austria.

7. This stranger died on the 19th of November 1703; and a few days before his death, he told the apothecary of the Bastille, that he believed he was about 60 years of age. Supposing that he was then 59 and a half, he must have been born towards the end of May 1644; and if he was 60 wanting three months, he must have been born in the end of August, or the beginning of September, of the same year; a period when the royal authority was in the hands of Anne of Austria, but in reality exercised more by Mazarine than by her. "I have already proved (continues the author), that from the first day of the regency of Anne of Austria, the greatest friendship, and even intimacy, subsisted between this prince and the cardinal; that these sentiments were changed into a mutual love; and that they were afterwards united by the bonds of marriage. They might, therefore, well have a son about the month of September 1644, as Louis XIII. had been then dead more than 15 months, having died on the 15th of May the year preceding. But nothing of what I have related, or of what has been written, and acknowledged as fact, respecting the man with the iron mask, can be applied, except to a son of Mazarine and Anne of Austria. The man with the iron mask was indebted, therefore, for his existence to cardinal Mazarine, and the regent widow of Louis XIII."—To account for the

the manner in which the queen was able to conceal her pregnancy and delivery, Madame de Motteville is quoted; who relates, under the year 1644, that Anne of Austria quitted the Louvre, because her apartments there displeased her: that she went to reside at the Palais-Royal, which Richlieu, when he died, bequeathed to the deceased king: that when she first occupied this lodging, *she was dreadfully afflicted with the jaundice*: that the physicians ascribed this disorder to her dejection and application to business, which gave her much embarrassment: but that being cured of her melancholy, as well as of her malady, she resolved to think only of enjoying tranquillity; which she did, by communicating to her minister the burden of public affairs. On this quotation, M. de St Mihiel asks, "Is it not very singular, that the queen, who, during the 29 years of her former wedded state, had always resided in the Louvre, especially from 1626, when Louis XIII. ceased to cohabit with her, until their re-union, which took place in the beginning of December 1637, should have quitted it precisely in 1644, because she was displeased with her apartments? How happened it that her apartments displeased her this year, and neither sooner nor later? She might undoubtedly have had any kind of furniture there which she desired, and every alteration made according to her wishes, as she was then absolute mistress: but the cause of her determination is plain; the apartments of the Palais-Royal, which front a garden, were much more convenient for her to be delivered in secret."

8. As it is necessary that some name should be given to every man, in order to distinguish him from another, that of *Marchiali* was given to the man with the iron mask: a name which evidently shows, that it had been invented by an Italian. [Cardinal Mazarine was a native of Piccina in the Abruzzo.]

9. Anne of Austria was remarkably delicate respecting every thing that touched her person. It was with great difficulty that cambric could be found fine enough to make shifts and sheets for her. Cardinal Mazarine once rallying her on this subject, said, *That if she should be damned, her punishment in hell would be to sleep in Holland sheets.* The predominant taste of the man with the iron masque, was to have lace and linen of the most extraordinary fineness. "Who (says the author) does not perceive, in this similarity of tastes, the maternal tenderness of Anne of Austria, who would have thought her son a great sufferer had he not been indulged with fine linen?"

"Louis XIII. (continues M. de St Mihiel) was a husband of a gloomy disposition, and an enemy to pleasure: while the queen, on the contrary, was fond of social life; and introduced at the court of France, especially after she became free, that ease and politeness which distinguished it under Louis XIV. from all the other courts of Europe. Louis XIII. had also a disagreeable countenance, and a breath so offensive, that it was a punishment for Richlieu to remain near him. It is clear, therefore, that she could not be much pleased with such a husband. When she became regent of the kingdom by the king's death, which happened on the 14th of May 1643, as she had not enjoyed that happiness which arises from a close union of hearts, it will not appear extraordinary

that she should indulge the affection she entertained for cardinal Mazarine, and that she should marry him. Every circumstance that could tend to favour such a marriage will be found united in her situation. She was at a distance from her family; absolute mistress of all her actions; and had, besides, a heart formed for love. Mazarine, though a cardinal, had never entered into orders; he gave out that he was descended from a great family; he was handsome and well made; he was of a mild, insinuating disposition, and remarkably engaging in conversation; and his office, as prime minister, afforded him every opportunity of visiting and conversing with the queen whenever he thought proper. Is it, therefore, so very astonishing, that, with so many advantages, he was able to captivate the queen so far as to induce her to marry him? Such a marriage was not, indeed, according to the usual course of things. Yet it was not without many precedents, particularly among sovereigns of the other sex, who had given their hands to persons of inferior rank. Thus Christian IV. of Denmark espoused Christina Monck; Frederick IV. espoused Mademoiselle Reventlau; James II. heir to the throne of England, married the daughter of a counsellor; Peter the Great raised to the throne Catharine I. the daughter of a poor villager, yet perhaps the most accomplished woman at that time between the Vistula and the pole; and Louis XIV. espoused the widow of a poet, but a woman possessed of the most extraordinary merit. As the women, however, are not forgiven so readily as the men for entering into such marriages, Anne of Austria kept hers a secret from this motive, and because she would have been in danger of losing the regency of the kingdom had it been known."

The reasoning of M. de St Mihiel is both ingenious and plausible; though the probability of the account is somewhat diminished by considering what must have been the queen's age at this period, after she had been Louis's wife for 29 years before his death.—The account immediately preceding, without this objection, seems abundantly credible. But whether, upon the whole, either of them can be received as decisive, or whether the mystery of the iron mask remains still to be unravelled, we must leave to the reader to determine.

MASQUE, in architecture, is applied to certain pieces of sculpture, representing some hideous forms, grotesque, or satyr's faces, &c. used to fill up and adorn vacant places, as in friezes, the panels of doors, keys of arches, &c. but particularly in grottos.

MASQUERADE, or MASCARADE, an assembly of persons masked or disguised, meeting to dance and divert themselves. This was much in use with us, and has been long a very common practice abroad, especially in carnival time.

The word comes from the Italian *mascarata*, and that from the Arabic *maskara*, which signifies "rillery, buffoonery." Granacci, who died in 1543, is said to have been the first inventor of masquerades.

MASRAKITHA, a pneumatic instrument of music among the ancient Hebrews, composed of pipes of various sizes, fitted into a kind of wooden chest, open at the top, and stopped at the bottom with wood covered with a skin. Wind was conveyed to it from the

Maf.

the lips, by means of a pipe fixed to the chest: the pipes were of lengths musically proportioned to each other, and the melody was varied at pleasure, by stopping and unstopping with the fingers the apertures at the upper extremity. See Plate CCLXXIX.

MASS, in mechanics, the matter of any body cohering with it, *i. e.* moving and gravitating along with it. In which sense, *mas* is distinguished from bulk, or volume, which is the expansion of a body in length, breadth, and thickness.

The mafs of any body is rightly estimated by its weight. And the masses of two bodies of the same weight are in a reciprocal ratio of their bulks.

MASS, *Missa*, in the church of Rome, the office or prayers used at the celebration of the eucharist; or in other words consecrating the bread and wine into the body and blood of Christ, and offering them to transubstantiate as an expiatory sacrifice for the quick and the dead.

As the mafs is in general believed to be a representation of the passion of our blessed Saviour, to every action of the priest, and every particular part of the service, is supposed to allude to the particular circumstances of his passion and death.

Nicod, after Baronius, observes that the word comes from the Hebrew *missach*, (*oblatum*); or from the Latin *missa missurum*; as common in the former times, the catechumens and excommunicated were sent out of the church, when the deacons said, *Ite, missa est*, after sermon and reading of the epistle and gospel; they not being allowed to assist at the consecration. Menage derives the word from *missio*, "dismissing;" Others from *missa*, "missing, sending;" because in the mafs, the prayers of men on earth are sent up to heaven.

The general division of masses consists in high and low. The first is that sung by the choristers, and celebrated with the assistance of a deacon and sub-deacon; low masses are those in which the prayers are barely rehearsed without singing.

There are a great number of different or occasional masses in the Romish church, many of which have nothing peculiar but the name: such are the masses of the saints; that of St Mary of the snow, celebrated on the fifth of August; that of St Margaret, patroness of lying-in women; that of the feast of St John the Baptist, at which are said three masses; that of the Innocents, at which the gloria in excelsis and the hallelujah are omitted, and it being a day of mourning, the altar is of a violet-colour. As to ordinary masses, some are said for the dead, and, as is supposed, contribute to fetch the soul out of purgatory: at these masses the altar is put in mourning, and the only decorations are a cross in the middle of six yellow wax-lights; the dress of the celebrant, and the very mass-book, are black; many parts of the office are omitted, and the people are dismissed without the benediction. If the mafs be said for a person distinguished by his rank or virtues, it is followed with a funeral oration; they erect a *chapelle ardente*, that is, a representation of the deceased with branches and tapers of yellow wax, either in the middle of the church, or near the deceased's tomb, where the priest pronounces a solemn absolution of the deceased. There are likewise private masses said for stolen or strayed goods or cattle,

VOL. X. Part II.

for health, for travellers, &c. which go under the name of *votive masses*. There is still a further distinction of masses denominated from the countries in which they were used; thus the Gothic mafs, or *missa mosarabum*, is that used among the Goths when they were masters of Spain, and which is still kept up at Toledo and Salamanca; the Ambrosian mafs is that composed by St Ambrose, and used only at Milan, of which city he was bishop; the Gallic mafs, used by the ancient Gauls; and the Roman mafs, used by almost all the churches in the Romish communion.

Mass of the Pre-sanctified, (*missa pre-sanctificatorum*), is a mafs peculiar to the Greek church, in which there is no consecration of the elements; but after singing some hymns, they receive the bread and wine which was before consecrated. This mafs is performed all Lent, except on Saturdays, Sundays, and the annunciation. The priest counts upon his fingers the days of the ensuing week on which it is to be celebrated, and cuts off as many pieces of bread at the altar as he is to say masses; and after having consecrated them, steep them in wine, and then puts them in a box; out of which, upon every occasion, he takes some of it with a spoon, and putting it on a dish sets it upon the altar.

MASSA, a town of Italy, in the kingdom of Naples, and in the Terra di Lavoro, with a bishop's see; seated on a mountain near the sea, in E. Long. 10. 0. N. Lat. 43. 5.

MASSA, an ancient, populous, and handsome town of Italy, and capital of a small territory of the same name, with the title of a principality, and a strong castle. It is famous for its quarries of fine marble, and is situated in E. Long. 14. 23. N. Lat. 40. 40.

MASSACHUSETTS COLONY, the principal subdivision of New England, having Hampshire on the north, the Atlantic ocean on the east and south, and Connecticut and New York on the west. It is about 100 miles long, and 40 broad. See *New ENGLAND*.

MASSACRE, a term used to signify the sudden and promiscuous butchery of a multitude. The most atrocious example of this kind upon record is that called the *Parisian MASSACRE*, or *Massacre of St Bartholomew's Day*. The Parisian massacre was carried on with such detestable perfidy, and executed with such a bloody cruelty, as would surpass all belief, were it not attested by the most undeniable evidence. In the year 1572, in the reign of Charles IX. many of the principal protestants were invited to Paris, under a solemn oath of safety, upon occasion of the marriage of the king of Navarre with the French king's sister, viz. the king of Navarre's mother, Coligni admiral of France, with other nobles. The queen-dowager of Navarre, a zealous protestant, was poisoned by a pair of gloves before the marriage was solemnized; and on the 24th of August 1572, being Bartholomew's day, about day-break, upon the toll of the bell of the church of St Germain, the butchery began. The admiral was basely murdered in his own house; and then thrown out of the window, to gratify the malice of the duke of Guise: his head was afterwards cut off, and sent to the king and queen-mother; and his body, after a thousand indignities offered to it, hung up by the feet on a gibbet. After this,

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Massacre. the murderers ravaged the whole city of Paris, and butchered in three days above ten thousand lords, gentlemen, prebends, and people of all ranks. An horrible scene of things, says Thuanus, when the very streets and passages resounded with the noise of those that met together for murder and plunder; the groans of those who were dying, and the shrieks of such as were just going to be butchered, were every where heard; the bodies of the slain thrown out of the windows; the courts and chambers of the houses filled with them; the dead bodies of others dragged through the streets, their blood running down the channels in such plenty, that torrents seemed to empty themselves in the neighbouring river: and, in a word, an innumerable multitude of men, women with child, maidens, and children, were all involved in one common destruction; and the gates and entrances of the king's palace all besmeared with their blood.

From the city of Paris the massacre spread almost throughout the whole kingdom. In the city of Meaux they threw above two hundred into jail; and after they had ravished and killed a great number of women, and plundered the houses of the protestants, they executed their fury on those they had imprisoned, and calling them out one by one, they were killed, as Thuanus expresses, like sheep in a market; the bodies of some were flung into ditches, and of others into the river Maine. In Orleans they murdered above five hundred men, women, and children, and enriched themselves with their spoil. The same cruelties were practised at Angers, Troyes, Bourges, La-Charité, and especially at Lyons, where they inhumanly destroyed above eight hundred protestants; children hanging on their parents necks; parents embracing their children; putting ropes about the necks of some, dragging them through the streets, and throwing them, mangled, torn, and half-dead, into the river.

It would be endless to mention the butcheries committed at Valence, Romaine, Rouen, &c. We shall, therefore, only add, that, according to Thuanus, above thirty thousand protestants were destroyed in this massacre, or, as others with greater probability affirm, above one hundred thousand.

Thuanus himself calls this a most detestable villainy; and, in abhorrence of St Bartholomew's days, used to repeat these words of P. Statius, *Silv. v. iiii. ver. 88. &c.*

*Excidit illa dies avo, ne postera creant
Secula. Nos certe tacemus, et obruta multa
Nocte tegi propriæ potius crimina gentis.*

In the words of Job, chap. iii. ver. 3. &c. "Let that day perish; and let it not be joined unto the days of the year. Let darkness and the shadow of death stain it," &c. And yet, as though this had been the most heroic transaction, and could have procured immortal glory to the authors of it, medals were struck at Paris in honour of it.

But how was the news of this butchery received at Rome, that faithful city, that holy mother of churches! How did the vicar of Christ, the successor of Peter, and the father of the Christian world, relish it? Let Thuanus tell the horrid truth. When the news, says he, came to Rome, it was wonderful to see how they exulted for joy. On the 6th of September, when the letters of the pope's legate were read in the assembly

of the cardinals, by which he assured the Pope that all was transacted by the express will and command of the king, it was immediately decreed that the pope should march with his cardinals to the church of St Mark, and in the most solemn manner give thanks to God for so great a blessing conferred on the see of Rome and the Christian world; and that on the Monday after, solemn mass should be celebrated in the church of Minerva; at which the pope, Greg. XIII. and cardinals were present; and that a jubilee should be published throughout the whole Christian world, and the cause of it declared to be, to return thanks to God for the extirpation of the enemies of the truth and church in France. In the evening the cannon of St Angelo were fired, to testify the public joy; the whole city illuminated with bonfires; and no one sign of rejoicing omitted that was usually made for the greatest victories obtained in favour of the Roman church.

MASSAGETAE, an ancient people about whose seat there is as much doubt as about that of the Amazons: Tibullus and Ammian place them near Albania, beyond the Araxes, which sometimes denotes the Oxus; it is probable they dwelt to the east of Sogdiana, (Dionysius Periegetes, Herodotus, Arrian).

MASSALIANS, a set of enthusiasts who sprang up about the year 361, in the reign of the emperor Constantius, who maintained that men have two souls, a celestial and a diabolical, and that the latter is driven out by prayer.

MASSANIELLO, see *History of Naples*.

MASSETER, in anatomy. See there, (*Table of the Muscles*).

MASSICOT, see MASTICOT.

MASSIEU (William), a learned French writer, member of the academy of belles lettres, and of the French academy, was born at Caen in Normandy in 1665, and completed his studies at Paris, when he entered amongst the Jesuits; but afterwards left them, that he might follow his inclination to polite literature with the greater freedom. In 1710 he was made Greek professor in the royal college; and enjoyed that post till his death, which happened at Paris in 1722. He wrote, 1. Several curious dissertations in the memoirs of the academy of inscriptions. 2. A history of the French poetry, in 12mo, &c.

MASSILIA, (anc. geog.) a town of Gallia Narbonensis, a colony of Phœceans, from Phœcæa, a city of Ionia, and in confederacy with the Romans; universally celebrated, not only for its port, commerce, and strength, but especially for its politeness of manners and for its learning. According to Strabo, it was the school for barbarians, who were excited by its means to a fondness for Greek literature, so that even their public and private transactions were all executed in that language. Strabo adds, "At this day the noblest Romans repair thither for study rather than to Athens." Now MARSEILLES, a city and port-town of Provence.

MASSILLON (Jean Baptiste), son of a notary at Hieres in Provence, was born in 1663, and entered into the congregation of the oratory in 1681. He gained the affections of every person in the towns to which he was sent, by the charms of his genius, the liveliness of his character, and by a fund of the most delicate

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Maffillon. delicate and affecting politeness. His first attempts in the art of eloquence were made at Vienna, while he was professor of theology. His funeral oration on Henry de Villars, archbishop of that city, received universal approbation. This success induced Father de la Tour, who was at that time general of the congregation, to call him to Paris. After he had been there for some time, he was asked what he thought of the preachers who made a figure on that great theatre?—"I find them possessed of great genius and abilities (answered he); but if I preach, I will not preach like them." He in fact kept his word, and struck out a new path in this great field of eloquence. P. Bourdaloue was excepted from the number of those whom he proposed not to imitate. If he did not take him for a model in every thing, the reason was, that his genius led him to a different species of eloquence.—His manner of composing, therefore, was peculiar to himself; and, in the opinion of men of taste and judgment, was superior to that of Bourdaloue. The affecting and natural simplicity of the father of the oratory, (said a great man), appear fitter to bring home the truths of Christianity to the heart than all the dialectics of the Jesuit. We must seek for the logic of the gospel in our own breasts; and the most powerful reasonings on the indispensable duty of relieving the distressed, will make no impression on that man who has beheld without concern the sufferings of his brother. If logic is necessary, it is only in matters of opinion; and these are fitter for the press than for the pulpit, which ought not to be the theatre of learned discussions. The truth of these reflections was clearly perceived when he appeared at court. Upon preaching his first advent sermon at Versailles, he received this eulogium from the mouth of Louis XIV. "Father, when I hear others preach, I am very well pleased with them; but whenever I hear you, I am dissatisfied with myself." The first time he preached his famous sermon on the small number of the elect, the whole audience were, at a certain place of it, seized with a sudden and violent emotion, and almost every person half rose from his seat by a kind of involuntary movement. The murmur of acclamation and surprise was so great, that it threw the orator into confusion; but this only heightened the impression of that pathetic discourse. What was most surprising in Maffillon, was his descriptions of the world, which were so sublime, so delicate, and so striking in the resemblance. When he was asked whence a man, like him, whose life was dedicated to retirement, could borrow them? he answered, "From the human heart; however little we examine it, we will find in it the seeds of every passion. When I compose a sermon (added he), I imagine myself consulted upon some doubtful piece of business. I give my whole application to determine the person who has recourse to me, to act the good and proper part. I exhort him, I urge him, and I leave him not till he has yielded to my persuasions." His declamation did not fail to be accompanied with success. "We think we see him in our pulpits (say those who had the pleasure of hearing him), with the simple air, the modest carriage, the down-cast and humble looks, the easy gesture, the affecting tone, and the countenance of a man deeply penetrated with his subject, conveying the clearest information to the

understanding, and raising the most tender emotions in the heart." Baron, the famous comedian, having met him one day in a house which was open for the reception of men of letters, paid him this compliment: "Continue to deliver as you do. Your manner is peculiar to yourself; leave the observance of rules to others." When this famous actor came from hearing one of his sermons, truth drew from him the following confession, which is so humiliating to his profession: "Friend (said he to one of his companions who accompanied him), here is an orator; we are only actors."

In 1704 Maffillon made his second appearance at court, and displayed still more eloquence than before. Louis XIV. after expressing his satisfaction to him, added, in the most gracious tone of voice, *Et je veux, mon pere, vous entendre tous les deux ans.* These flattering encomiums did not lessen his modesty. When one of his fellows was congratulating him upon his preaching admirably, according to custom, "Oh! give over, Father (replied he), the devil has told me so already, much more eloquently than you." The duties of his office did not prevent him from enjoying society; and in the country he forgot that he was a preacher, but always without trespassing against decency. One day when he was at the house of M. de Crozat, the latter said to him, "Father, your doctrine terrifies me, but I am encouraged by your life." He was chosen, on account of his philosophical and conciliatory disposition of mind, to reconcile the cardinal de Noailles with the Jesuits. All he gained by his attempts was the displeasure of both parties; and he found that it was easier to convert sinners than to reconcile theologians. In 1717, the regent, personally acquainted with his merit, appointed him to the bishopric of Clermont. The next year, being destined to preach before Louis XV. who was only nine years of age, he composed in six weeks those discourses which are so well known by the name of *Petit Carême*. These are the chief d'œuvre of this orator, and indeed of the oratorical art. They ought continually to be read by preachers as models for the formation of their taste, and by princes as lessons of humanity.

Maffillon was admitted into the French academy a year afterwards, in 1719. The abbey of Savigny becoming vacant, the cardinal du Bois, to whom he had been weak enough to give an attestation for being a priest, procured it for him. The funeral oration of the dukes of Orleans, in 1723, was the last discourse he pronounced in Paris. He never afterwards left his diocese, where his gentleness, politeness, and kindness, had gained him the affection of all who knew him. He reduced the exorbitant rights of the episcopal roll to moderate sums. In two years, he caused 22,000 livres to be privately conveyed to the Hotel-Dieu of Clermont. His peaceable disposition was never more displayed than while he was a bishop. He took great pleasure in collecting the fathers of the oratory and the Jesuits at his country-house, and in making them join in some diversion. He died on the 28th of September 1743, at the age of 70. His name has become that of eloquence itself. Nobody ever knew better how to touch the passions. Preferring sentiment to every thing else, he communicated to the soul that lively and salutary emotion which ex-

Maffillon.

cites in us the love of virtue. What pathetic eloquence did his discourses display! what knowledge of the human heart! what constant disclosing of a mind deeply affected with his subject! what strain of truth, philosophy, and humanity! what imagination, at once the most lively, and guided by the soundest judgment! Just and delicate thoughts; splendid and lofty ideas; elegant, well chosen, sublime, and harmonious expressions; brilliant and natural images; true and lively colouring; a clear, neat, swelling, and copious style, equally suited to the capacity of the multitude, and fitted to please the man of genius, the philosopher, and the courtier, form the character of Maffillon's eloquence, especially in his *Petit Carême*. He could at once think, describe, and feel. It has been justly observed concerning him, that he was to Bourdaloue what Racine was to Corneille. To give the finishing stroke to his eulogium, Of all the French orators, he is the most esteemed by foreigners.

An excellent edition of Maffillon's works was published by his nephew at Paris in 1745 and 1746, in 14 vols. large 12mo, and 12 vols. of a small size.—Among them we find, 1. Complete sets of Sermons for Advent and Lent. It is particularly in his moral discourses, such as are almost all those of his sermons for Advent and Lent, that Maffillon's genius appears. He excels, says M. d'Alembert, in that species of eloquence, which alone may be preferred to all others, which goes directly to the heart, and which agitates without wounding the soul. He searches the inmost recesses of the heart, and lays open the secret workings of the passions, with so delicate and tender a hand, that we are hurried along rather than overcome. His diction, which is always easy, elegant, and pure, every where partakes of that noble simplicity, without which there can be neither good taste nor true eloquence; and this simplicity is, in Maffillon, joined to the most attractive and the sweetest harmony, from which it likewise borrows new graces. In short, to complete the charm produced by this enchanting style, we perceive that these beauties are perfectly natural; that they flow easily from this source, and that they have occasioned no labour to the composer. There even occur sometimes in the expressions, in the turns, or in the affecting melody of his style, instances of negligence which may be called happy, because they completely remove every appearance of labour. By thus abandoning himself to the natural current of thought and expression, Maffillon gained as many friends as hearers. He knew, that the more anxious an orator appears to raise admiration, he will find those who hear him the less disposed to bestow it. 2. Several Funeral Orations, Discourses, and Panegyrics, which had never been published. 3. Ten discourses, known by the name of *Petit Carême*. 4. The *Conferencées ecclésiastiques*, which he delivered in the seminary of St Magloire upon his arrival at Paris; those which he delivered to the curates of his diocese; and the discourses which he pronounced at the head of the synods which he assembled every year. 5. Paraphrases on several of the Psalms. The illustrious author of these excellent tracts wished that they had introduced into France a practice which prevails in England, of reading sermons instead of preaching them from

mory; a custom which is very convenient, but by which all the warmth and fervour of eloquence are lost. He, as well as two others of his brethren, had stood short in the pulpit exactly on the same day.—They were all to preach at different hours on Good-Friday, and they went to hear one another in succession. The memory of the first failed, which so terrified the other two, that they experienced the same fate. When our illustrious orator was asked, what was his best sermon? he answered, "That which I am most master of." The same reply is ascribed to Bourdaloue. The celebrated P. la Rue was of the opinion of Maffillon, that getting by heart was a slavery which deprived the pulpit of a great many orators, and which was attended with many inconveniences to those who dedicated themselves to it. The Abbé de la Porte has collected into 1 vol. 12mo the most striking ideas, and the most sublime strokes, which occur in the works of the celebrated bishop of Clermont. This collection, which is made with great judgment, appeared at Paris in 1748, 12mo, and forms the 15th volume of the large edition in 12mo, and the 13th of the small in 12mo. It is entitled, *Pensées sur différents sujets de morale et de piété, tirées, &c.*

MASSINGER (Philip), an English dramatic poet, was born at Salisbury about the year 1581, and was educated at Oxford. He left the university without taking any degree; and went to London to improve his poetical genius by polite conversation. There he wrote many tragedies and comedies, which were received with vast applause; and were greatly admired for the economy of the plots and the purity of the style. He was at the same time a person of the most consummate modesty; which rendered him extremely beloved by the poets of his time, particularly by Fletcher, Middleton, Rowley, Field, and Decker, who thought it an honour to write in conjunction with him. He was as remarkable for his abilities as his modesty. He died suddenly at his house on the Bank-side in Southwark, near the play-house; and was interred in St Saviour's church-yard, in the same grave with Mr Fletcher the poet.

MASSIVE, among builders, an epithet given to whatever is too heavy and solid: thus a massive column is one too short and thick for the order whose capital it bears; and a massive wall is one whose openings or lights are too small in proportion.

MASSON (Papirius), a French writer, was the son of a rich merchant, and born in the territory of Forez, May 1541. After studying the belles lettres and philosophy, and travelling to different places, he came to Paris, where he was made librarian to the chancellor of the duke of Anjou, in which place he continued ten years. In 1576, he was made an advocate of parliament; yet never pleaded but one cause, which, however, he gained with universal applause.—When the troubles of France were at an end, he married the sister of a counsellor in parliament, with whom he lived thirty-four years, but had no issue by her.—The infirmities of age attacked him some time before his death, which happened Jan. 9, 1611. He wrote four books of French annals in Latin, first printed at Paris 1577, and afterwards in 1598, 4to. The second edition, more enlarged than the first, deduces

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things from Pharamond to Henry II. Maffon considered this as his principal performance; yet he is now chiefly known by his *Elogia virorum clarissimorum*, although he published several other works.

MASSON (John), a reformed minister in Holland some years ago. He was originally of France, but fled into England to enjoy that liberty in religion which his country refused him. He wrote, 1. *Histoire critique de la république des lettres*, from 1712 to 1717, in 15 vols. 12mo. 2. *Vite Horatii, Ovidii, et Plinii junioris*, 3 vols small 8vo, and printed abroad, though dedicated to Englishmen of rank: the first at Leyden, 1708, to lord Harvey; the second at Amsterdam, 1708, to Sir Justinian Isham; the third at Amsterdam, 1709, to the bishop of Worcester. These lives are drawn up in a chronological order, very learnedly and very critically; and serve to illustrate the history, not only of those particular persons, but of the times also in which they lived. 3. *Histoire de Pierre Bayle et de ses ouvrages*; Amsterdam, 1716, in 12mo. This at least is supposed to be his, though at first it was given to M. la Monnoye.

MASSON (Anthony), an eminent French engraver, who flourished towards the conclusion of the last century, and resided chiefly at Paris. It appears that he sometimes amused himself with painting portraits from the life, some of which he also engraved. We have no account of the life of this extraordinary artist; nor are we even informed from what master he learned the principles of engraving. He worked entirely with the graver, and handled that instrument with altonifying facility. He seems to have had no kind of rule to direct him with respect to the turning of the strokes; but twitted and tired them about, without the least regard to the different forms he intended to express, making them entirely subservient to his own caprice. Yet the effect he has produced in this singular manner (Mr Strutt observes), is not only far superior to what one could have supposed, but is often very picturesque and beautiful. It was not in historical engraving that his greatest strength consisted. He could not draw the naked parts of the human figure so correctly as was necessary; but where the subject required the figures to be clothed, he succeeded in a wonderful manner. Among the most esteemed works by this admirable artist, may be reckoned the following: The assumption of the Virgin, a large upright plate from Rubens; a holy family, a middling-sized plate, lengthwise, from N. Mignard; Christ with the pilgrims at Emaus, a large plate, lengthwise, from Titian, the original picture of which is in the cabinet of the king of France. This admirable print is commonly known by the name of the *table-cloth*; for the cloth, with which the table is covered, is executed in a very singular style. Also the following portraits, among others: The comte de Harcourt, a large upright plate, reckoned a masterpiece in this class of subjects; Guillaume de Brisiac, secretary to the queen of France; a middling-sized upright plate: usually known in England by the name of the *Grey-headed Man*, because the hair in this print is so finely executed.

MASSUAH, a small island in the Red Sea, near the coast of Abyssinia, about three quarters of a mile long, and half as broad, one-third of which is occu-

Maffuah.

piated by houses, another by cisterns for receiving rain-water, and one reserved for a burial place. It has an excellent harbour, with water sufficiently deep for ships of any size to the very edge of the island; and so well secured, that they may ride in safety, let the wind blow from what quarter or with what degree of strength it will. By the ancients it was called *Sebafium Ors*, and was formerly a place of great consequence on account of its harbour, from whence a very extensive commerce was carried on, and possessed a share of the Indian trade in common with other ports of the Red Sea near the Indian Ocean.—A very considerable quantity of valuable goods was also brought thither from the tract of mountainous country behind it, which in all ages has been accounted very un hospitable, and almost inaccessible to strangers. The principal articles of exportation were gold, ivory, elephants, and buffaloes hides; but above all slaves, who, on account of their personal qualifications, were more esteemed than those from any other quarter.—Pearls of a considerable size, and of a fine water, are likewise found along the coast; from the abundance of all which valuable commodities, the great defect, a want of water, was forgot, and the inhabitants cheerfully submitted to such a great inconvenience. The island of Maffuah fell under the power of the Turks in the time of the emperor Selim, soon after the conquest of Arabia Felix by Sinan Pasha, and was for some time governed by an officer from Constantinople. From thence the conquest of Abyssinia was for some time attempted, but always without success. Hence it began to lose its value as a garrison for troops, as it had done in the commercial way after the discovery of the passage to India by the Cape of Good Hope.—Being thus deprived of its importance in every respect, the Turks no longer thought it worth while to send a pasha thither as formerly, but conferred the government upon the chief of a tribe of Mahometans named *Belawie*, who inhabit the coasts of the Red Sea under the mountains of Habab, in the latitude of about 14° north. On this officer they conferred the title of *Naybe*; and on the removal of the pasha, he remained in fact master of the place, though, to save appearances, he pretended to hold it from the Ottoman Porte, by a firman from the Grand Signior for that purpose, and the payment of an annual tribute.

The Turks had originally put into the town of Maffuah a garrison of Janizaries; who, being left there on the withdrawing of the pasha, and intermarrying with the natives, soon became entirely subjected to the Naybe's influence. The latter, finding himself at a great distance from his protectors the Turks, whose garrisons were every where falling into decay, and that in consequence of this he was entirely in the power of the emperor of Abyssinia, began to think of taking some method of securing himself on that side. Accordingly it was agreed that one half of the customs should be paid to the Abyssinian monarch; who in return was to allow him to enjoy his government unmolested. Having thus secured the friendship of the emperor of Abyssinia, the Naybe began gradually to withdraw the tribute he had been accustomed to pay to the pasha of Jidda, to whose government Maffuah had been assigned; and at last to pay a little regard to the government of Abyssinia; and in this state of

Maſſuah.

independence he was when Mr Bruce arrived there in 1760 on his way to Abyſſinia. This gentleman found both the prince and his people extremely unhoſpitable and treacherous; ſo that he underwent a variety of dangers during his reſidence there, nor was it without great difficulty that he could get away from thence at laſt.

The iſland of Maſſuah, as we have ſaid, is entirely deſtitute of water; nor can it be ſupplied with provisions of any kind but from the mountainous country of Abyſſinia on the continent. Arkeeko, a large town in the bottom of the bay, has water, but is in the ſame predicament with regard to provisions; for the adjacent tract of flat land, named *Sambar*, is a perfect deſart, inhabited only from the month of November to April by ſome wandering tribes, who carry all their cattle to the Abyſſinian ſide of the mountains when the rains fall there. Being thus in the territories of the Abyſſinians, it is in the power of the emperor of that country, or of his officer the Bahama-gaſſi, to ſtarve Maſſuah and Arkeeko, by prohibiting the paſſage of any provisions from the Abyſſinian ſide of the mountains.

The houſes of Maſſuah are generally conſtructed of long poles and bent graſs, as is uſual with other towns of Arabia: only about 20 are of ſtone, and fix or eight of theſe two ſtories high. The ſtones with which they are built have been drawn out of the ſea; and in them the bed of that curious muſcle found embodied in the ſolid rock at Mahon is frequently to be ſeen. Theſe are called *dattoli da mare*, or ſea-dates: but our author never ſaw any of the fiſh themſelves, though he has no doubt that they may be met with in the rocky iſlands of Maſſuah if they would take the trouble of breaking the rocks for them. All the neceſſaries of life are very dear in this place; and their quality is alſo very indifferent, owing to the diſtance from whence they muſt be brought, and the danger of carrying them through the deſart of Sambar, as well as to the extortions of the Naybe himſelf, who, under the name of *cuiſtoms*, takes whatever part of the goods he thinks proper; ſo the profit left to the merchant is ſometimes little or nothing. All the money here is valued by the Venetian ſequin; and it is owing to the commercial intercourſe with the Arabian coaſt that any money at all is to be met with on this iſland or the eaſtern coaſt of Africa. Glaſs beads of all kinds and colours, whether whole or broken, paſs for ſmall money.

Though Maſſuah has now loſt very much of its commercial importance, a conſiderable trade is ſtill carried on from the place. From the Arabian ſide are imported blue cotton and other cloths; ſome of them from India being very fine. Other articles are Venetian beads, cryſtal, looking and drinking glaſſes, with cobol or crude antimony. Theſe three laſt articles come in great quantity from Cairo, firſt in the coffee-ſhips to Jidda, and then in ſmall barks to the port of Maſſuah. Old copper is alſo a valuable article of commerce. The Galla and all the various tribes to the weſtward of Gondar wear bracelets of this metal, which in ſome parts of that barbarous country is ſaid to ſell for its weight of gold. Here is alſo a ſhell, an univalve of the ſpecies of volutes, which ſells at an high price, and paſſes for money among the various

tribes of Galla. The Baſians were once the principal merchants of Maſſuah; but their number is now reduced to fix, who are ſilver-Smiths, and ſubſiſts by making ornaments for the women on the continent. They likewiſe eſſay gold, but make a poor livelihood.

MASSUET (Rene, or Renatus), a very learned Benedictine of the congregation of St Maur, was born at S. Owen de Macelles, in 1664. He is chiefly known for the new edition of St Irenæus, which he publiſhed in 1710. He conſulted ſeveral manuſcripts, which had never been examined, for that purpoſe, and made new notes and learned prefaces. He died in 1716, after having written and publiſhed ſeveral other works.

MAST, a long round piece of timber, elevated perpendicularly upon the keel of a ſhip, to which are attached the yards, the ſails, and the rigging. A maſt, with regard to its length, is either formed of one ſingle piece, which is called a *pole-maſt*, or composed of ſeveral pieces joined together, each of which retains the name of maſt ſeparately. The loweſt of theſe is accordingly named the *lower-maſt*, *a*, fig. 1. the next in height is the top-maſt, *b*, which is erected at the head of the former; and the higheſt is the top-gallant maſt, *c*, which is prolonged from the upper end of the top-maſt. Thus the two laſt are no other than a continuation of the firſt upwards.

The lower-maſt is fixed in the ſhip by an apparatus, deſcribed in the articles HULK and SHEERS: the foot, or heel of it, reſts in a block of timber called the *ſtep*, which is fixed upon the *keelson*: and the top-maſt is attached to the head of it by the *cap* and the *treſſle-trees*. The latter of theſe are two ſtrong bars of timber, ſupported by two prominences, which are as ſhoulders on the oppoſite ſides of the maſt, a little under its upper end: athwart theſe bars are fixed the *cross-trees*, upon which the frame of the top is ſupported. Between the lower-maſt-head and the foremoſt of the *cross-trees*, a ſquare ſpace remains vacant, the ſides of which are bounded by the two *treſſle-trees*. Perpendicularly above this is the foremoſt hole in the cap, whole after-hole is ſolidly fixed on the head of the lower-maſt. The top-maſt is erected by a tackle, whole effort is communicated from the head of the lower-maſt to the foot of the top-maſt; and the upper end of the latter is accordingly guided into and conveyed up through the holes between the *treſſle-trees* and the cap, as above-mentioned. The machinery by which it is elevated, or, according to the ſea-phraſe, *ſwayed up*, is fixed in the following manner: the top rope *d*, fig. 2. paſſing through a block *e*, which is hooked on one ſide of the cap, and afterwards through a hole, furniſhed with a ſheave or pulley *f*, on the lower end of the top-maſt, is again brought upwards on the other ſide of the maſt, where it is at length ſtrained to an eye bolt in the cap *g*, which is always on the ſide oppoſite to the top-block *e*. To the lower end of the top-rope is fixed the top-tackle *h*, the effort of which being tranſmitted to the top-rope *d*, and thence to the heel of the top-maſt *i*, neceſſarily liſts the latter upwards, parallel to the lower-maſt. When the top-maſt is raiſed to its proper height, fig. 3. the lower end of it becomes firmly wedged in the ſquare hole above deſcribed, between the *treſſle-trees*. A bar of wood or iron called the *ſid*, is then thruſt through a hole *i* in the heel of

Maſſuet,
Maſt.Plate
CCLXXXI

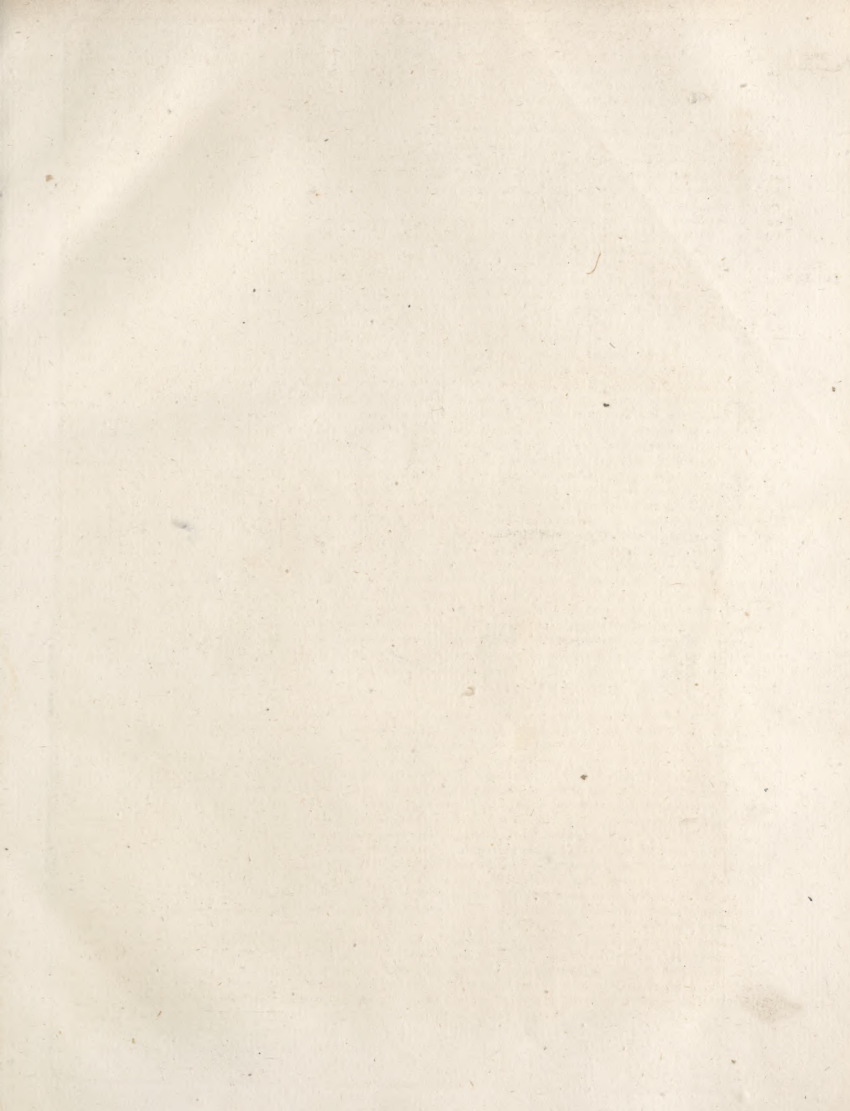


Fig. 2. Fig. 3.

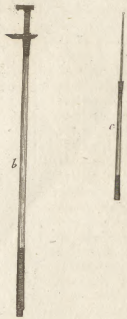


Fig. 6.

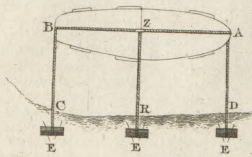


Fig. 4.

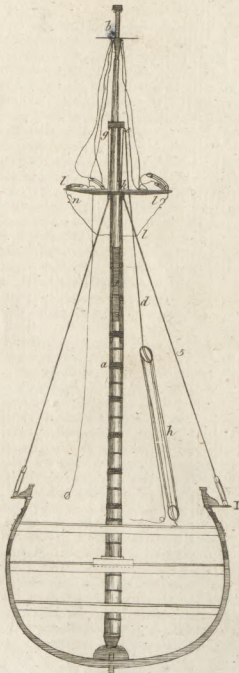


Fig. 5.

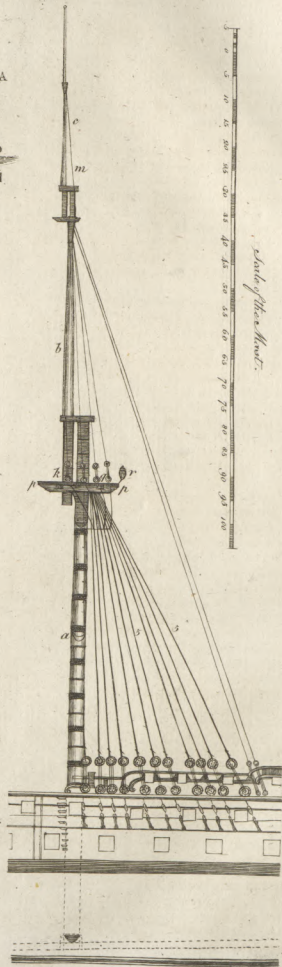


Fig. 1.



Mast.

it, across the tressle-trees, by which the whole weight of the top-mast is supported.

In the same manner as the top-mast is retained at the head of the lower-mast, the top-gallant-mast is erected, and fixed at the head of the top-mast.

Besides the parts already mentioned in the construction of masts, with respect to their length, the lower-masts of the largest ships are composed of several pieces united into one body. As these are generally the most substantial parts of various trees, a mast, formed by this assemblage, is justly esteemed much stronger than one consisting of any single trunk, whose internal solidity may be very uncertain. The several pieces are formed and joined together, as represented in the section of a lower-mast of this sort, fig. 5, where *a* is the shaft, or principal piece into which the rest are fixed, with their sides or faces close to each other. The whole is secured by several strong hoops of iron, driven on the outside of the mast, where they remain at proper distances.

The principal articles to be considered in equipping a ship with masts are, 1st, the number; 2d, their situation in the vessel; and, 3d, their height above the water.

The masts being used to extend the sails by means of their yards, it is evident, that if their number were multiplied beyond what is necessary, the yards must be extremely short, that they may not entangle each other in working the ship, and by consequence their sails will be very narrow, and receive a small portion of wind. If, on the contrary, there is not a sufficient number of masts in the vessel, the yards will be too large and heavy, so as not to be managed without difficulty. There is a mean between these extremes, which experience and the general practice of the sea have determined; by which it appears, that in large ships every advantage of sailing is retained by three masts and a bowsprit.

The most advantageous position of the masts is undoubtedly that from whence there results an equilibrium between the resistance of the water on the body of the ship on one part, and of the direction of their effort on the other. By every other position this equilibrium is destroyed, and the greatest effort of the masts will operate to turn the ship horizontally about its direction; a circumstance which retards her velocity. It is counterbalanced indeed by the helm; but the same inconvenience still continues; for the force of the wind, having the resistance of the helm to overcome, is not entirely employed to push the vessel forward. The axis of the resistance of the water should then be previously determined, to discover the place of the *main-mast*, in order to suspend the efforts of the water equally, and place the other masts so as that their particular direction will coincide with that of the *main-mast*. The whole of this would be capable of a solution if the figure of the vessel were regular, because the point, about which the resistance of the water would be in equilibrium, might be discovered by calculation.

But when the real figure of the ship is considered, these flattering ideas will instantly vanish. This observation induced M. Savieren to employ a mechanical method to discover the axis of resistance of the water, which he apprehended might be used with success in the manner following:

When the vessel is launched, before the places of the masts are determined, extend a rope AB, fig. 6. from the head to the stern. To the extremities A and B attach two other ropes, AD, BC, and apply to the other ends of these ropes two mechanical powers, to draw the ship according to the direction BC, parallel to itself. The whole being thus disposed, let a moveable tube Z, fixed upon the rope AB, have another rope ZR attached to it, whose other end communicates with a mechanical power R, equal to the two powers D and C. This last being applied to the same vessel, in such manner as to take off the effects of the two others by sliding upon the rope AB, so as to discover some point Z, by the parallelism of the ropes AD, BC feebly extended with the rope ZR; the line ZR will be the axis of the equilibrium of the water's resistance, and by consequence the *main-mast* should be planted in the point Z.

The figures F, E, E, are three windlasses on the shore, by which this experiment is applied.

With regard to the situation of the other masts, it is necessary, in the same manner, to discover two points; so that the direction of the two mechanical powers operating, will be parallel to the axis of resistance RZ already found.

The exact height of the masts, in proportion to the form and size of the ship, remains yet a problem to be determined. The more the masts are elevated above the centre of gravity, the greater will be the surface of sail which they are enabled to present to the wind; so far an additional height seems to have been advantageous. But this advantage is diminished by the circular movement of the mast, which operates to make the vessel stoop to its effort; and this inclination is increased in proportion to the additional height of the mast, an inconvenience which it is necessary to guard against. Thus what is gained upon one hand is lost upon the other. To reconcile these differences, it is certain, that the height of the mast ought to be determined by the inclination of the vessel, and that the point of her greatest inclination should be the term of this height above the centre of gravity. See the article TRIM.

With regard to the general practice of determining the height of the masts, according to the different rates of the ships in the royal navy, the reader is referred to the article SAIL.

In order to secure the masts, and counterbalance the strain they receive from the effort of the sails impressed by the wind, and the agitation of the ship at sea, they are sustained by several strong ropes, extended from their upper ends to the outside of the vessel, called *shrouds*, as represented in fig. 4. They are further supported by other ropes, stretched from their heads towards the fore-part of the vessel.

The mast, which is placed at the middle of the ship's length, is called the *main-mast*; that which is placed in the forepart, the *fore-mast*; and that which is towards the stern, is termed the *mizen-mast*.

N. B. *Mizen* is applied to this mast by all the nations of Europe, except the French, who alone call the fore-mast *misaine*.

MASTER, a title given to several officers and persons of authority and command; particularly to the:

Mast.

Master.

Plate

CCLXXXI

Plate

CCLXXXI

Master.

the chiefs of the orders of knighthood, &c.—Thus we say the grand-master of Malta; of St Lazarus; of the golden fleece; of the free masons, &c.

MASTER (magister), was a title frequent among the Romans: they had their master of the people, *magister populi*, who was the dictator. Master of the cavalry, *magister equitum*, who held the second post in an army after the dictator. Under the later emperors there were also masters of the infantry, *magistri peditum*. A master of the census, *magister census*, who had nothing of the charge of a censor, or subcensor, as the name seems to intimate; but was the same with the *prepositus frumentariorum*.

MASTER of the Militia (magister militie), was an officer in the lower empire, created, as it is said, by Dioclesian, who had the inspection and government of all the forces, with power to punish, &c. somewhat like a constable of France. At first there were two of these officers instituted, the one for the infantry, and the other for the cavalry; but the two were united into one under Constantine. Afterwards, as their power was increased, so was their number also; and there was one appointed for the court, another for Thrace, another for the East, and another for Illyria. They were afterwards called *comites*, *counts*, and *clarissimi*. Their power was only a branch of that of the *praefectus praetorii*, who by that means became a civil officer.

MASTER of Arms (magister armorum), was an officer or comptroller under the master of the militia.

MASTER of the Offices (magister officiorum), had the superintendence of all the officers of the court: he was also called *magister officii palatini*; simply *magister*; and his post *magisterialis*.—This officer was the same in the western empire with the *curiales* in the eastern.

MASTER at Arms, among us, is an officer appointed to teach the officers and crew of a ship of war the exercise of small arms; to confine and plant sentinels over the prisoners, and superintend whatever relates to them during their confinement. He is also to observe that the fire and lights are all extinguished as soon as the evening-gun is fired, except those which are permitted by proper authority, or under the inspection of sentinels. It is likewise his duty to attend the gangway when any boats arrive aboard, and search them carefully, together with their rowers, that no spirituous liquors may be conveyed into the ship unless by permission of the commanding officer. In these several duties he is assisted by proper attendants, called his *corporals*, who also relieve the sentinels and one another at certain periods.

MASTER of Arts, the first degree taken up in foreign universities, but the second in ours; candidates not being admitted to it till they have studied in the university seven years.

MASTER-Attendant, is an officer in the royal dockyards, appointed to hasten and assist at the fitting out or dismantling, removing, or securing vessels of war, &c. at the port where he resides. He is particularly to observe, that his majesty's ships are securely moored, and for this purpose he is expected frequently to review the moorings which are sunk in the harbour, and observe that they are kept in proper repair. It is also his duty to visit all the ships in ordinary, and see that they are frequently cleaned and kept in or-

No 196.

der; and to attend at the general musters in the dockyards, taking care that all the officers, artificers, and labourers, registered at the navy-books, are present at their duty.

MASTER of the Ceremonies, is an officer instituted by King James I. for the more solemn and honourable reception of ambassadors, and strangers of quality, whom he introduces into the presence.—The badge of this office is a gold chain and medal, having on one side an emblem of peace, with King James's motto; and on the reverse the emblem of war, with *Dieu et mon droit*. He is always supposed to be a person of good address, and a master of languages, and has an appointment of 300l. a year: he is constantly attending at court, and hath under him an assistant-master, or deputy, at 6s. 8d. a day, who holds his place during the king's pleasure.

There is also a third officer, called *marshal of the ceremonies*, with 100l. a-year, whose business is to receive and distribute the master's order, or the deputy's, for the service; but without their order he can do nothing. This is the king's gift.

MASTERS of Chancery are usually chosen out of the barristers of the common law; and sit in chancery, or at the rolls, as assistants to the lord chancellor and the master of the rolls. All these, so late as the reign of Queen Elizabeth, were commonly doctors of the civil law.—To them are also committed interlocutory reports, examination of bills in chancery, stating of accounts, taxing costs, &c. and sometimes, by way of reference, they are empowered to make a final determination of causes.

They have time out of mind had the honour to sit in the lords house, though they have neither writ nor patent to empower them; but they are received as assistants to the lord chancellor and master of the rolls. They had anciently the care of inspecting all writs of summons, which is now performed by the clerk of the petty-bag. When any message is sent from the lords to the commons, it is carried by the masters of chancery. Before them also affidavits are made, and deeds and recognizances acknowledged.

Besides these, who may be called *masters of chancery ordinary* (being 12 in number, whereof the master of the rolls is reputed the chief), there are also masters of chancery extraordinary, appointed to act in the several counties of England beyond 10 miles distance from London, by taking affidavits, recognizances, &c. for the ease of the suitors of the court.

MASTER of the Faculties, an officer under the archbishop of Canterbury, who grants licences and dispensations: he is mentioned in the statute 22 and 23 Car. II. See *Court of Faculties*.

•*MASTER-Gunner*. See *GUNNER*.

MASTER of the Horse is reckoned the third great officer of the court, and is an office of great honour and antiquity, and always (when not put in commission) filled by noblemen of the highest rank and abilities. He has the management and disposal of all the king's stables and bred horses. He has authority over the equerries and pages, coachmen, footmen, grooms, riders of the great horse, farriers, and smiths. He appoints all the other tradesmen who work for the king's stables; and by his warrant to the avenor, makes them give an oath to be true and faithful. In short, he is

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Master.

entrusted with all the lands and revenues appropriated for the king's breed of horses, the expences of the stable, and of the coaches, litters, &c. He alone has the privilege of making use of any of the king's horses, pages, footmen, &c.; and at any solemn cavalcade he rides next the king, and leads a horse of state. His salary is £.1276 : 13 : 4 *per annum*. There is also a master of the horse in the establishment of her majesty's household, with a salary of 800*l.* a-year.

MASTER of the Household, is an officer under the treasurer of the household, in the king's gift : his business is to survey the accounts of the household.—He has £. 66 : 13 : 4 a-year wages, and £. 433 : 6 : 8 board-wages.

MASTER of the Mint, was anciently the title of him who is now called *warden of the mint* ; whose office is to receive the silver and bullion which comes to the mint to be coined, and to take care thereof. The office of master and worker is now distinct : and this officer is allowed for himself and three clerks 650*l.* a-year.

MASTER of the Ordnance. See *ORDNANCE*.

MASTER of the Revels, an officer with an appointment of 100*l.* a-year, whose business is to order all things relating to the performance of plays, masques, balls, &c. at court. Formerly he had also a jurisdiction of granting licences to all who travel to act plays, puppet-shows, or the like diversions ; neither could any new play be acted at either of the two houses till it had passed his perusal and licence ; but these powers were afterwards much abridged, not to say annihilated, by a statute for regulating playhouses, till the licensing plays by the lord chamberlain was established. This officer has a yeoman with £.46 : 11 : 8 a-year.

MASTER of the Rolls, a patent-officer for life ; who has the custody of the rolls and patents which pass the great seal, and of the records of the chancery.

In the absence of the lord chancellor or keeper, he also sits as judge in the court of chancery ; and is by Sir Edward Coke called his *assitant*.

At other times he hears causes in the rolls-chapel, and makes orders and decrees. He is also the first of the masters of chancery, and has their assistance at the rolls : but all hearings before him are appealable to the lord chancellor.

He has also his writ of summons to parliament, and sits next to the lord chief justice of England on the second woolpack. He has the keeping of the parliament-rolls, and has the rolls-house for his habitation ; as also the custody of all charters, patents, commissions, deeds, and recognizances, which being made of rolls of parchment gave rise to the name. Anciently he was called *clerk of the rolls*.

Concerning the authority of the master of the rolls to hear and determine causes, and his general power in the court of chancery, there were (not many years since) divers questions and disputes very warmly agitated ; to quiet which it was declared by stat. 3. Geo. II. cap. 30. that all orders and decrees by him made, except such as by the course of the court were appropriated to the great seal alone, should be deemed to be valid ; subject nevertheless to be discharged or altered by the lord chancellor, and so as they shall

not be inrolled till the same are signed by his lordship.

In his gift are the six clerks in chancery, the examiners, three clerks of the petty-bag, and the six clerks of the rolls-chapel where the rolls are kept. See *ROLLS*, *CLERK*, &c.

The master of the rolls is always of the privy-council ; and his office is of great profit, though much short of what it has been.

MASTER of a Ship, an officer to whom is committed the direction of a merchant-vessel, who commands it in chief, and is charged with the merchandises aboard.

In the Mediterranean the master is frequently called *patron*, and in long voyages *captain*.

It is the proprietor of the vessel that appoints the master ; and it is the master who provides the equipment, hires the pilots, sailors, &c. The master is obliged to keep a register of the seamen and officers, the terms of their contract, the receipts and payments, and, in general, of every thing relating to his commission.

MASTER of a Ship of War, is an officer appointed by the commissioners of the navy, to take charge of navigating a ship from port to port under the direction of the captain. The management and disposition of the sails, the working of a ship into her station in the order of battle, and the direction of her movements in the time of action, and in other circumstances of danger, are also more particularly under his inspection. It is likewise his duty to examine the provisions, and accordingly to admit none into the ship but such as are sound, sweet, and wholesome. He is moreover charged with the stowage ; and for the performance of these services he is allowed several assistants who are properly termed *mates* and *quarter-masters*.

MASTER of the Temple. The founder of the order of the templars, and all his successors were called *magni templi magistri* ; and ever since the dissolution of the order, the spiritual guide and director of the house is called by that name. See *TEMPLE* and *TEMPLAR*.

There were also several other officers under this denomination, as master of the wardrobe, with a salary of 2000*l.* a-year ; master of the harriers, with 2000*l.* a-year ; master of the stag-hounds, with 800*l.* a-year ; master of the jewel-office, &c. all now abolished.

MASTER and Servant ; a relation founded in convenience, whereby a man is directed to call in the assistance of others, where his own skill and labour will not be sufficient to answer the cares incumbent upon him. For the several sorts of servants, and how that character is created or destroyed, see the article *SERVANT*. In the present article we shall consider, first, the effect of this relation with regard to the parties themselves ; and secondly, its effects with regard to others.

1. The manner in which this relation affects either the master or servant. And, first, by hiring and service for a year, or apprenticeship under indentures, a person gains a settlement in that parish wherein he last served 40 days. In the next place, persons serving seven years as apprentices to any trade have an exclusive right to exercise that trade in any part of England. This law, with regard to the exclusive part of

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Master.

it, has by turns been looked upon as a hard law, or as a beneficial one, according to the prevailing humour of the times: which has occasioned a great variety of resolutions in the courts of law concerning it; and attempts have been frequently made for its repeal, tho' hitherto without success. At common law every man might use what trade he pleased; but this statute restrains that liberty to such as have served as apprentices: the adversaries to which provision say, that all restrictions (which tend to introduce monopolies) are pernicious to trade; the advocates for it allege, that unskilfulness in trades is equally detrimental to the public as monopolies. This reason indeed only extends to such trades, in the exercise whereof skill is required: but another of their arguments goes much farther; viz. that apprenticeships are useful to the commonwealth, by employing of youth, and learning them to be early industrious; but that no one would be induced to undergo a seven years servitude, if others, tho' equally skilful, were allowed the same advantages without having undergone the same discipline: and in this there seems to be much reason. However, the resolutions of the courts have in general rather confined than extended the restriction. No trades are held to be within the statute, but such as were in being at the making of it: for trading in a country village, apprenticeships are not requisite, and following the trade seven years is sufficient without any binding; for the statute only says, the person must serve *as an apprentice*, and does not require an actual apprenticeship to have existed.

A master may by law correct his apprentice for negligence or other misbehaviour, so it be done with moderation: though, if the master or master's wife beats any other servant of full age, it is good cause of departure. But if any servant, workman, or labourer, assaults his master or dame, he shall suffer one year's imprisonment, and other open corporal punishment, not extending to life or limb.

By service all servants and labourers, except apprentices, become intitled to their wages: according to agreement, if menial servants; or according to the appointment of the sheriff or sessions, if labourers or servants in husbandry: for the statutes for regulation of wages extend to such servants only; it being impossible for any magistrate to be a judge of the employment of menial servants, or of course to assess their wages.

2. Let us now see how strangers may be affected by this relation of master and servant; or how a master may behave towards others on behalf of his servant, and what a servant may do on behalf of his master.

And, first, the master may *maintain*, that is, abet and assist, his servant in any action at law against a stranger: whereas, in general, it is an offence against public justice to encourage suits and animosities, by helping to bear the expence of them, and is called in law *maintenance*. A master also may bring an action against any man for beating or maiming his servant: but in such case he must assign, as a special reason for so doing, his own damage by the loss of his service; and this loss must be proved upon the trial. A master likewise may justify an assault in defence of his servant,

Master.

and a servant in defence of his master: the master, because he has an interest in his servant, not to be deprived of his service; the servant, because it is part of his duty, for which he receives his wages, to stand by and defend his master. Also if any person do hire or retain my servant, being in my service, for which the servant departeth from me and goeth to serve the other, I may have an action for damages against both the new master and the servant, or either of them: but if the new master did not know that he is my servant, no action lies; unless he afterwards refuse to restore him upon information and demand. The reason and foundation upon which all this doctrine is built, seem to be the property that every man has in the service of his domestics; acquired by the contract of hiring, and purchased by giving them wages.

As for those things which a servant may do on behalf of his master, they seem all to proceed upon this principle, that the master is answerable for the act of his servant, if done by his command, either expressly given or implied: *nam qui facit per alium, facit per se*. Therefore, if the servant commit a trespass by the command or encouragement of his master, the master shall be guilty of it: not that the servant is excused, for he is only to obey his master in matters that are honest and lawful. If an innkeeper's servants rob his guests, the master is bound to restitution; for as there is a confidence reposed in him, that he will take care to provide honest servants, his negligence is a kind of implied consent to the robbery; *nam, qui non prohibet, cum prohibere possit, jubet*. So likewise if the drawer at a tavern sells a man bad wine, whereby his health is injured, he may bring an action against the master; for although the master did not expressly order the servant to sell it to that person in particular, yet his permitting him to draw and sell it at all is impliedly a general command.

In the same manner, whatever a servant is permitted to do in the usual course of his business, is equivalent to a general command. If I pay money to a banker's servant, the banker is answerable for it: if I pay it to a clergyman's or a physician's servant, whose usual business it is not to receive money for his master, and he imbezcles it, I must pay it over again. If a steward lets a lease of a farm, without the owner's knowledge, the owner must stand to the bargain; for this is the steward's business. A wife, a friend, a relation, that use to transact business for a man, are *quoad hoc* his servants; and the principal must answer for their conduct: for the law implies, that they act under a general command; and without such a doctrine as this no mutual intercourse between man and man could subsist with any tolerable convenience. If I usually deal with a tradesman by myself, or constantly pay him ready money, I am not answerable for what my servant takes up upon trust; for here is no implied order to the tradesman to trust my servant: but if I usually send him upon trust, or sometimes on trust and sometimes with ready money, I am answerable for all he takes up; for the tradesman cannot possibly distinguish when he comes by my order and when upon his own authority.

If a servant, lastly, by his negligence does any damage to a stranger, the master shall answer for his neglect:

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||
Maſtic.

glect: if a ſmith's ſervant lames a horſe while he is ſhoeing him, an action lies againſt the maſter, and not againſt the ſervant. But in theſe caſes the damage muſt be done while he is actually employed in the maſter's ſervice; otherwiſe the ſervant ſhall anſwer for his own miſbehaviour. Upon this principle, by the common law, if a ſervant kept his maſter's fire negligently, ſo that his neighbour's houſe was burned down thereby, an action lay againſt the maſter; becauſe this negligence happened in his ſervice: otherwiſe, if the ſervant, going along the ſtreet with a torch, by negligence ſets fire to a houſe; for there he is not in his maſter's immediate ſervice, and muſt himſelf anſwer the damage perſonally. But now the common law is, in the former caſe, altered by ſtatute 6 Ann. c. 3. which ordains, that no action ſhall be maintained againſt any in whole houſe or chamber any fire ſhall accidentally begin; for their own loſs is ſufficient puniſhment for their own or their ſervant's careleſſneſs. But if ſuch fire happens through negligence of any ſervant (whoſe loſs is commonly very little), ſuch ſervant ſhall forfeit (col. to be diſtributed among the ſufferers; and, in default of payment, ſhall be committed to ſome workhouſe, and there kept to hard labour for 18 months. A maſter is, laſtly, chargeable if any of his family layeth or caſteth any thing out of his houſe into the ſtreet or common highway, to the damage of any individual, or the common nuisance of his majeſty's liege people: for the maſter hath the ſuperintendence of all his houſehold. And this alſo agrees with the civil law; which holds, that the *pater familias*, in this and ſimilar caſes, *ob alterius culpam tenetur, ſive ſervi, ſive liberi*.

We may obſerve, that in all the caſes here put, the maſter may be frequently a loſer by the truſt reposed in his ſervant, but never can be a gainer: he may frequently be answerable for his ſervant's miſbehaviour, but never can ſhelter himſelf from puniſhment by laying the blame on his agent. The reaſon of this is ſtill uniform and the ſame; that the wrong done by the ſervant is looked upon in law as the wrong of the maſter himſelf; and it is a ſtanding maxim, that no man ſhall be allowed to make any advantage of his own wrong.

MASTER-Load, in mining, a term uſed to expreſs the larger vein of a metal, in places where there are ſeveral veins in the ſame hill. Thus it often happens, that there are ſeven, ſometimes five, but more uſually three veins or loads, parallel to each other, in the ſame hill. Of theſe the middle vein is always much the largeſt. This is called the *maſter-load*; and the others which lie three, two, or one on each ſide of this, are called the *concomitants* of the maſter-load.

MASTER-Word, in botany. See **IMPERATORIA**.

MASTICATION, the action of chewing, or of agitating the ſolid parts of our food between the teeth, by the motion of the jaws, the tongue, and the lips, whereby it is broken into ſmall pieces, impregnated with ſaliva, and ſo fitted for degluſtion and a more eaſy digeſtion. See **ANATOMY**, n° 104.

MASTICH, a kind of reſin exuding from the lenticeſcus tree; and brought from Chio, in ſmall yellowiſh tranſparent grains or tears, of an agreeable ſmell, eſpecially when heated or ſet on fire. See **PISTACHIA**.

This reſin is recommended in old coughs, dyſenteries, hæmopto's, weakneſs of the ſtomach, and in general in all debilities and laxity of the fibres. Geoffroy directs an aqueous decoction of it to be uſed for theſe purpoſes: but water extracts little or nothing from this reſin. Rectified ſpirit almoſt entirely diſſolves it, and the ſolution is very warm and pungent. Maſtic is to be choſen in drops, clear, well-ſcented, and brittle.

We meet with a kind of cement ſometimes kept in the ſhops under the name of maſtic. It is compoſed of this gum, and ſeveral other ingredients, and is formed into cakes for uſe. This is intended for the ſervice of lapidaries, to fill up cracks in ſtones, &c. but is by no means to be uſed for any medicinal purpoſes.

MASTICOT, or **YELLOW LEAD**, is the calx or aſhes of lead, gently calcined, by which it is changed to a yellow or lighter or deeper teint, according to the degree of calcination. Maſticot is ſometimes uſed by painters, and it ſerves medicinally as a drier in the compoſition of ointments or plaiſters. The maſticot which is uſed by the Dutch as the ground of their glazing, is prepared by calcining a mixture of one hundred weight of clean ſand, forty-four pounds of ſoda, ſold wiſh us under the name of barilla, and thirty pounds of pearl-aſhes.

MASTIFF-DOG, or **BAND-DOG**, (*canis villaticus* or *catenarius*), is a ſpecies of great ſize and ſtrength, and a very loud barker. Manwood ſays, that it derives its name from *maſte theſſe*, being ſuppoſed to frighten away robbers by its tremendous voice. Great Britain was formerly ſo noted for its maſtiſſs, that the Roman emperors appointed an officer in this iſland, with the title of *Procurator Cynegii*, whoſe ſole buſineſs was to breed, and tranſmit from hence to the amphitheatre, ſuch as would prove equal to the combats of the place. Strabo, lib. iv. tells us, that the maſtiſſs of Britain were trained for war, and uſed by the Gauls in their battles. See **CANIS**.

MASTIGADOUR, or **SLABBERING-BIT**, in the manege, a ſnaffle of iron, all ſmooth, and of a piece, guarded with paternoſters, and compoſed of three halves of great rings, made into demi-ovals, of unequal bigneſs; the leſſer being incloſed within the greater, which ought to be about half a foot high.

MASULAPATAN, a populous town of Aſia in the Eaſt Indies, and on the coaſt of Coromandel, in the dominions of the Great Mogul. It carried on a great trade, and moſt nations in Europe had factories here; but the Engliſh have now left it, and even the Dutch themſelves have not above a dozen people here to carry on the chintz trade. The inhabitants are Gentoos, who will not feed on any thing that haſt life; and they had a famous manufacture of chintz, which is greatly decayed ſince the Engliſh left off buying. The Great Mogul has a cuſtom-houſe here; and the adjacent countries abound in corn, tobacco, and timber for building. It is ſeated on the welt ſide of the Bay of Bengal, 200 miles north of fort St George. W. Long. 81. 25. N. Lat. 16. 30.

MATACA, or **MANTACA**, a commodious bay in America, on the north coaſt of the iſland of Cuba. Here the galleons uſually come to take in freſh water

Maſticot
||
Mataca.

Mataman in their return to Spain. It is 35 miles from the Havannah. W. Long. 85. 6. N. Lat. 25. 0.

Matching.

MATAMAN, a country of Africa, bounded by Benguela on the north, by Monomotopa on the east, by Cafria on the south, and by the Atlantic Ocean on the west. There is no town in it, and the inhabitants live in miserable huts, it being a desert country, and but little visited by the Europeans.

MATAN, or **MATAN**, an island of Asia in the East-Indian sea, and one of the Philippines. The inhabitants have thrown off the yoke of Spain; and it was here that Magellan was killed in April 1521.

Cape MATAPAN, the most southern promontory of the Morea, between the gulph of Corau and that of Colo-China.

MATARAM, a large town of Asia, formerly the capital of an empire of that name in the island of Java. It is strong by situation, and is seated in a very fertile, pleasant, and populous country, surrounded with mountains. E. Long. 111. 25. S. Lat. 7. 55.

MATARO, a town of Spain, in Catalonia; seated on the coast of the Mediterranean, 15 miles north-east of Barcelona, and 35 south-west of Gironne. It is a small town, but industrious and well-peopled; and the environs abound in vineyards, which produce wine much famed for its flavour. It likewise contains several manufactories, and is considered as one of the richest and most active towns in Catalonia. E. Long. 2. 35. N. Lat. 41. 30.

MATCH, a kind of rope slightly twisted, and prepared to retain fire for the uses of artillery, mines, fire-works, &c.

It is made of hempen-tow, spun on the wheel like cord, but very slack; and is composed of three twits, which are afterwards again covered with tow, so that the twits do not appear: lastly, it is boiled in the lees of old wines. This, when once lighted at the end, burns on gradually and regularly, without ever going out till the whole be consumed: the hardest and driest match is generally the best.

Quick-Match. See *Quick-Match*.

MATCHING, in the wine-trade, the preparing vessels to preserve wines and other liquors, without their growing foul or vapid. The method of doing it is as follows: Melt brimstone in an iron ladle, and when thoroughly melted, dip into it slips of coarse linen-cloth; take these out, and let them cool: this the wine-coopers call a *match*. Take one of these matches, set one end of it on fire, and put it into the bung-

hole of a cask; stop it loosely, and thus suffer the match to burn nearly out: then drive in the bung tight, and set the cask aside for an hour or two. At the end of this time examine the cask, and you will find that the sulphur has communicated a violent pungent and suffocating scent to the cask, with a considerable degree of acidity, which is the gas and acid spirit of the sulphur. The cask may after this be filled with a small wine which has scarce done its fermentation; and bunging it down tight, it will be kept good, and will soon clarify: this is a common and very useful method; for many poor wines could scarce be kept potable even a few months without it.

MATE of a *SHIP OF WAR*, an officer under the direction of the master, by whose choice he is generally appointed, to assist him in the several branches of his duty. Accordingly, he is to be particularly attentive to the navigation in his watch, &c. to keep the *log* regularly, and examine the line and glasses by which the ship's course is measured, and to adjust the sails to the wind in the fore-part of the ship. He is to have a diligent attention to the cables, seeing that they are well coiled and kept clean when laid in the tier, and sufficiently served when employed to ride the ship. Finally, he is to superintend and assist at the stowage of the hold, taking especial care that all the ballast and provisions are properly stowed therein.

MATE of a *Merchant-Ship*, the officer who commands in the absence of the master thereof, and shares the duty with him at sea; being charged with every thing that regards the internal management of the ship, the directing her course, and the government of her crew.

The number of mates allowed to ships of war and merchantmen is always in proportion to the size of the vessel. Thus a first-rate man of war has six mates, and an East-Indiaman the same number; a frigate of 10 guns, and a small merchant-ship, but only one mate in each; and the intermediate ships have a greater or smaller number, according to their several sizes, or to the services on which they are employed.

DURA and **PIA MATER**, the names given by anatomists to the two membranes which surround the brain. See *ANATOMY*, n° 129, 130.

MATERA, a considerable town of Italy, in the kingdom of Naples, and in the Terra d'Otranto, with a bishop's see, seated on the river Canaparo. E. Long. 16. 43. N. Lat. 40. 51.

M A T E R I A M E D I C A,

Of Classification.

A GENERAL name for every substance used in medicine, and by some extended even to every article used as food or drink.

Thus the materia medica becomes exceedingly extensive; however, before we enter upon any particular discussion of the subject, it appears proper to give some general idea of medicines and their operation.

A *medicine*, properly so called, is a substance which, when applied to the living human body, makes such an alteration in it as either to prevent the approach of disease, or to remedy a morbid state when already present.

Such substances as may be used for these purposes without any great preparation are called *simple medicines*, or *simples*; and with these the writers on materia medica are chiefly conversant. In treatises written professedly on this subject, it is common to give a particular description of each article, the characteristic marks by which it may be distinguished from all other substances, and the methods by which an adulteration or an imperfection may be discovered in it, together with the dose in which it can safely be given: but as all these particulars are taken notice of in different

Mate, Matera.

Of Classification.

different parts of this work, it is only necessary here to mention the general classification, and enumerate the names of the various substances used in medicine, after giving, as hath been already promised, a brief and general account of their mode of operation.

Concerning the manner in which medicines act, physicians have greatly differed, and each has followed his own particular theory. The followers of Boerhaave have supposed their action to be directly upon the solids and fluids; while those who build their theories on the hypothesis of Hoffman have asserted, that all medicines act immediately upon the nervous system, and from thence only in a secondary manner are their effects diffused over the solids and fluids. To discuss this question is not our business at present: neither indeed is it a matter of great consequence whether it be discussed or not; seeing all parties must own, that certain effects follow the use of certain particular substances, whether these substances act first upon the nervous system or upon the solids and fluids.

From their operations on the human body medicines are most usually divided into classes. Some are found to have the property of rendering the solid parts of the body more lax than before, and are therefore called *relaxing* medicines: Others there are which have an effect directly contrary, and are therefore called *indurating* medicines: A third kind are found to excite inflammation in the part to which they are applied, and are therefore called *inflammatory* medicines: And, lastly, a fourth kind are found remarkably either to increase or diminish the vigour of the body, or what is called the *tone* of the solids; and have therefore got the name of *tonics* if they increase, and *sedatives* if they diminish, this tone.

Some medicines are supposed neither remarkably to increase nor diminish the tone of the solids; but to perform their office either by correcting some morbid matter in the body, or by evacuating it: in the former case they are called *alterants*, in the latter *evacuants*.

These are the general divisions or classes into which medicines are commonly divided; but when we begin more particularly to consider their virtues, a great many inferior divisions arise.—Of the relaxing medicines, some, when externally applied, are supposed only to soften the part; and in that case are called *emollients*: while others, which have a power of converting the humours stagnating in any inflamed part into pus, are called *maturants*, or *suppuratives*. Sedative medicines, externally applied, are sometimes called *paregories*: when taken internally, if they take off a spasm then existing in the body, they are called *antispasmodics*; if they mitigate pain, *anodynes*; if they produce a quiet sleep, *hypnotics*; or if they produce a very deep and unnatural sleep, together with a remarkable stupefaction of the senses, they are then called *narcotics*.

Tonic medicines obtain the name of *corroboratives*, *analptics*, or *nervine* medicines, when they slightly increase the contractile power of the solids; but of *astringents*, if they do this in a great degree, especially if at the same time that they indurate the solids they also coagulate the fluids. Some of these medicines have received names from their supposed virtue of pro-

moting the growth of the flesh, consolidating wounds, and stopping fluxes of blood: but it is now discovered that no medicines whatever are endowed with any such powers; and therefore the divisions into *sarcotics* *traumaticis*, or *vulneraries*, &c. are seldom used.

—If astringent medicines are used with an intention to drive, by the constriction which they occasion, any kind of matter from the surface towards the internal parts of the body, they are called *repellents*; but if they insensibly expel any kind of stagnating matter from the parts where it is contained, they are then called *discutients*; and lastly, *stimulants*, or *atractives*, if they bring a greater flux of humours to the part to which they are applied.

As to medicines of the inflammatory kind, they are divided into *vesicatories* or blisters, which by their application raise watery bladders on the skin; and *cathartics*, *eghoratics*, or *corrosives*, if they eat into and destroy the substance of the solid parts themselves. Another subdivision has been added, viz. that of *rube-factive* medicines, or such as only induce a redness on the part to which they are applied; but these belong to the vesicatories, and what proves only *rube-factive* to one will frequently blister another.

The alterants are divided into *absorbents*, such as by their alkaline quality neutralise and destroy any acid matter which may be in the stomach; and *antiseptics*, or those which correct any putrid matter in it; *coagulants* when they thicken the humours, and *resolvents* if they thin them; *heating* medicines when they increase the velocity of the blood, and *refrigerating* if they diminish it.

The evacuating medicines are divided according to the nature of the humour they evacuate. Thus, if they evacuate the contents of the stomach by vomiting, they are called *emetics*; if they induce purging, they are called *cathartics*; if they only evacuate the immediate contents of the intestines, they are named *ecoproctics*; or if a moderate evacuation is produced, without sickness or pain, they are called *laxatives*.—The medicines which gently promote the expulsion of humours through the pores of the skin, are called *diaphoretics*. If they do this in great quantity and with violence, they are called *sudorifics*. Such as excite urine, are called *diuretics*. Such as produce their evacuation by the glands of the palate, mouth, and salivary ducts, are called *salivatory* medicines; those which promote the evacuation of mucus from the throat, are called *apoplegmatics*; while those which evacuate by the nose, are called *ptarmics*, *errhines*, *sternutatories*; and those which promote the menstrual flux, *emmenagogues*.—To the order of evacuants also some reduce those medicines which expel any unnatural bodies, as worms, stones, and flatus. Those which destroy worms are called *anthelmintics*; those which dissolve the stone in the bladder, *lithoniptics*; and such as expel flatus, *carminatives*.

According to these divisions Mr Vogel classes the articles of his *Materia Medica*; but Dr Lewis chooses to arrange them according to the natural qualities of the substances themselves, and not their effects on the human body.

Writers on the *materia medica* (he observes) have taken great pains in arranging the various articles of which

which it is composed, into different divisions and subdivisions, according to their real or reputed medicinal powers.

It has been imagined, that the whole materia medica is reducible under the three distinctions of *alteratives*, *evacuants*, and *reforvatives*: the first comprehending all that has any power to alter the constitution, without sensibly increasing or diminishing any of the natural evacuations; the second, whatever visibly promotes those discharges; and the third, all that contributes to lessen them, and make the increase greater than the waste. These divisions being too general, they are broken into subdivisions; and these again are further divided into different classes, under more restrained denominations, as cardiac, carminative, hysseric, stomachic, &c.

Specious as this plan may appear to be, he imagines the execution of it, to any useful purpose, would require a far more extensive knowledge of the nature and operation of medicines than has yet been attained to. A just and useful method of simples is scarcely to be expected, while those properties on which the method is founded are imperfectly known, and in many articles only conjectural.

In all the arguments that have been hitherto contrived upon this plan, there appears a striking incongruity among the several articles of which even the ultimate subdivisions are composed; substances extremely dissimilar being classed together, as cantharides and tea, tobacco and bran, hemlock and cowslips, scurvy-grass and raisins, arum root and liquorice, wormwood and parsnips, cinnamon and nettles, raspberries and chalk, artichokes and alum, cloves and coffee, mustard-seed and black cherries, &c. Nor are these incongruities to be laid always to the charge of the authors, the nature of the system itself rendering them often unavoidable; for the particular effect which intitles a medicine to a particular class, may be produced by substances very dissimilar, and even opposite, in their general powers: thus the alvine excretions are restrained by starch, wax, tormentil-root, opium; among the capital diuretics are cantharides, nitre, salt, fixt alkaline salts, squills. It should seem that the method of arrangement cannot be a just one which requires substances so discordant to be ranked together, and which further requires each of these substances to be ranked over again, in other classes, along with other substances to which they are equally discordant.

There is also a material imperfection in this scheme, even in the primary divisions. Steel and its preparations act, in different circumstances, both as evacuants and reforvatives. Mercury and antimony afford, in their different preparations, both evacuants and alteratives; and there are many other drugs which are sometimes used as alteratives, and sometimes as evacuants; indeed, all evacuants, in diminished doses, seem to act merely as alteratives. It should seem therefore, that "the division of the whole materia medica into alteratives, evacuants, and reforvatives," is a division not founded in nature, even if there was no objection to the vague meaning of the appellations themselves.

Cartheuser has divided the materia medica on a

plan which appears more rational. Instead of the operations of medicines in the human body, which are precarious, complicated, and greatly diversified according to the dose, the preparation, and the circumstances of the patient, he takes for the basis of his arrangement their more simple, obvious, and constant properties, as bitterness, sweetness, astringency, acidity, &c. Having considered the nature of bitterness, for instance, in general, he examines what effects medicines possessed of this property are capable of producing in the body, and in what circumstances they may be expected to be serviceable, and then proceeds to an account of the particular bitters.

This method is of real use, but its use is limited to a small part of the materia medica. There are many of the medicinal simples, in which we can distinguish no prevailing qualities of this kind; there are many, in which different qualities are blended together; and many which, though similar in these kinds of qualities, are very dissimilar in their operations in the human body: thus though gentian and aloe agree in having a bitter taste, and sugar and manna in being sweet, their medicinal virtues are respectively very different. Accordingly, the author is obliged in some cases to depart from his general plan, and found the division on the medicinal effects: he makes one class of purgatives and emetics, and another of vaporous inebriants and narcotics: this last class consists of tobacco, elder-flowers, saffron, opium, and poppy-seeds, substances certainly very discordant in all their qualities that relate to medicinal intentions.

In this article, instead of attempting a medicinal distribution of the simples, which we apprehend not to be practicable to any good purpose, we shall, after Dr Lewis, adopt the alphabetical mode of arrangement, as possessing upon the whole a decided superiority over every other. We shall, however, premise, from the same ingenious author, some general observations on certain classes of medicines, in Cartheuser's manner; and thus preserve the less exceptionable parts of his plan, with some amendments.

ART. I. ACIDS.

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|---------------------------|---|--|
| | { | native; as sorrel, wood-sorrel, juice of lemon, oranges, barberries, and other fruits.
produced by fermentation; as vinegar and tartar. |
| | | |
| Class 1. <i>Vegetable</i> | | |
| Class 2. <i>Mineral</i> : | | the acids of vitriol, nitre, and common salt. |

THE medical effects of acids, duly diluted and given in proper doses, are, to cool, quench thirst, correct a tendency to putrefaction, and allay inordinate motions of the blood. By these qualities, in hot bilious temperaments and inflammatory disorders, they frequently restrain immoderate hæmorrhages, and promote the natural secretions; in some kinds of fever, they excite a copious diaphoresis, where the warm medicines, called *alexipharmics*, tend rather to prevent this salutary discharge.

Vegetable acids, particularly the native juices of certain plants and fruits, have some degree of a sapaceous quality; by means of which they attenuate

Absorbents, or dissolve viscid phlegm and deterge the vessels, and thus prove serviceable in sundry chronic disorders. Inveterate scurvy have sometimes yielded to their continued use, especially when given in conjunction with medicines of the acid or pungent kind: experience has shown, that the acid antiscorbutics have much better effects when thus managed than when exhibited by themselves; hence in the *Juci scorbutici* of our dispensatory, Seville orange juice is usefully joined to that of the *cochlearia* and *nasurtium*.

The mineral acids instantly coagulate blood: the vegetable dilute it, even when inspissated or thickened by heat; in which state, watery liquors will not mingle with it. Hence, in some fevers, where water runs off by the kidneys almost as pale and insipid as it was drank, vegetable acids render the urine of the due colour and quality. The mineral acids (the spirit of nitre in particular) combined with vinous spirits, have a like effect.

Acids are prejudicial in cold, pale, phlegmatic habits, where the vessels are lax, the circulation languid, bile deficient, and the power of digestion weak. In these cases, an acid is often generated in the stomach, from milk and moist vegetable foods; which, whilst it continues in the first passages, occasions uneasiness about the stomach, flatulencies, sometimes griping pains of the bowels, and vomitings.

ART II. INSIPID EARTHS *capable of* ABSORBING ACIDS.

Oyster-shells,	Chalk,
Crabs claws and eyes so called,	Some marles,
Coral, red and white,	Lime-stones,
Pearls,	Marbles,
Bezoar,	Spars.

The virtues of these substances are, to absorb or destroy acidities in the first passages, and consequently to remove such disorders as proceed from that cause. The cordial, alexipharmic, antifebrile, and other like virtues attributed to these medicines, appear to have little foundation; or at best are only secondary ones. When united with the acid, they form a neutral saline compound, possessing some degree of an aperient and detergent quality, though too inconsiderable to be in general regarded.

The absorbent earths were all strangers to medicine in the earlier times; and their use does not seem to have been established before the last century; when some practitioners, from an opinion that most kinds of diseases proceeded from a preternatural acid, introduced a great variety of antacid bones, both of the earthy and saline kind, and very liberally exhibited them on almost every occasion.

It is certain, that in children, and adults of a weak constitution, and whose food is chiefly of the vegetable acescent kind, sundry disorders are occasioned by acidities; these readily discover themselves by four eruptions, the pale colour of the face, and in children by the four smell and green colour of the alvine faeces, which are sometimes so manifestly acid as to raise a strong effervescence with alkaline salts. In

these cases, and these only, the use of absorbent earths **Absorbents** is indicated.

If there are really no acid juices in the ventricle, these earths are apt to concreate with the mucous matter usually lodged there, into hard indissoluble masses; which have sometimes been thrown up by vomit, or found in the stomach upon dissection. Hence indigestion, loss of appetite, nausea, vomiting, obstructions of the bowels, and other disorders. Sometimes the stomach and intestines have been found lined with a crust, as it were, of these earthy bodies, which must not only have prevented the separation of the gastric liquor, but likewise have closed the orifices of the lacteal vessels, so as to obstruct the passage of the chyle into the mass of blood.

Some suppose the earthy powders capable (without the concurrence of any acid) of passing the lacteals along with the chyle; and allege, in support of this opinion, that, when triturated with water, they are in part taken up and carried with it through a filter of paper; the filtrated liquor leaving, upon evaporation, a portion of whitish earthy matter. This experiment (allowing the consequence to be justly drawn from it) is itself erroneous: the residuum proceeds from the earth naturally contained in the water, not from that employed in the experiment; for if pure distilled water be made use of, it will leave no residuum, though long triturated or digested with the earth.

All these bodies, particularly those of the animal kind, contain, besides their purely alkaline earth, a portion of glutinous matter. An instance of this we have in crabs-eyes, which if macerated in the weaker acids, or in the stronger sufficiently diluted with water, the earthy part will be dissolved, and the animal-glue remain in form of a soft transparent mucilage. The glutinous substance increases their tendency to concreate in the stomach; and thence those which contain least thereof should be preferred to the others. The mineral earths contain the least of this kind of matter, and some of them are very easy of solution; chalk, for instance, which may therefore be given with greater safety than the animal-absorbents. These substances, divested of their conglutinating matter by means of fire, are reduced into acrimonious calces or limes, and thus become medicines of a different class.

The teeth, bones, hoof, and horns of animals consist of the same principles with the animal-absorbents above mentioned, but combined in different proportions: the quantity of gelatinous matter is so large, as to defend the earthy part from the action of weak acids; whilst the earth, in its turn, protects the gluten from being easily dissolved by watery liquors. Hence these bodies in their crude state, though recommended as possessing singular virtues, are not found to have any virtue at all.

Experiments have been made for determining the degree of solubility, or comparative strength of these earths; the principal of which are arranged in the two following tables, one taken from Langius, and the other from Homberg.

Absorbents.

TABLE of the quantity of Acid destroyed by different Absorbents.

Ten grains of	Some kinds of Limestone	destroyed the acidity of	160
	Oyster shells		120
	Chalk		100
	Shells of Garden-snails		100
	Calcined Cray-fish		100
	Pearls		80
	Tooth of the Sea-horse		80
	Volatile Salts		80
	Fixed Salts		60
	Coral, red and white		60
	Crabs-eyes		50
	Egg-shells		50
	Mother-of-Pearl		50
	Crabs-claws		40
	Jaw-bone of the Pike-fish		30

Drops of Spirit of Salt.

TABLE of the quantity of Absorbent Earths soluble in Acids.

576 grains of Spirit of Salt dissolved of	Crabs-eyes	216
	Mother-of-Pearl	144
	Pearls	128
	Oyster-shells	156
	Hartshorn	165
	Coral	186
	Oriental Bezoar	118
	Occidental Bezoar	123
576 grains of Spirit of Nitre dissolved of	Quick Lime	199
	Slacked Lime	193
	Crabs-eyes	277
	Mother-of-Pearl	202
	Pearls	219
	Oyster-shells	236
	Hartshorn	234
	Coral	233
	Oriental Bezoar	108
	Occidental Bezoar	144
	Quick Lime	180
	Slacked Lime	216

These experiments do not sufficiently ascertain the point intended by them: in the first sett, the quantity of acid is too vague and undetermined; in the second, we are not told whether the acid was perfectly saturated; and in both, the acids made use of were so very different from any that can be supposed ever to exist in the human body, that little can be concluded from them with regard to the medical effects of these absorbents. Trial should have been made with the mild vegetable acids, as the juices of certain fruits, four fermented liquors, or rather with four milk. Nevertheless these tables, though not so perfect as could be wished, have their use in the hands of such as can make proper allowances.

ART. III. EARTHS NOT DISSOLUBLE in Acids or other liquors.

These may be ranged in two classes.

Class 1. *Hard crystalline earths*: as the ruby, garnet, emerald, sapphire, hyacinth, and other precious stones; crystal, flint, &c.

THESE kind of substances were introduced into medicine, and many fabulous virtues attributed to them by the superstitious of the earlier ages. Some of them are still preserved in foreign pharmacopœias, but at length very justly expunged from ours, notwithstanding what some late writers of repute speak of their medicinal virtue. These indissoluble hard bodies are not capable of producing any other effect, than by their rigid angular particles (which, though levigated with the utmost care, the microscope still discovers in them) to offend or wound the intestines. In levigation, they wear off so much from the hardest marble instruments, as will equal or exceed their own weight: from this circumstance we may account for their having sometimes appeared to act as absorbents. Some of these stones, exposed to a vehement fire, become in some measure friable; but nevertheless remain indissoluble. Most of the coloured ones by this treatment lose their colour; and in this state prove nearly of the same quality with common crystal: such are, the sapphire, emerald, amethyst, and cornelian. Others melt into a blackish vitreous matter, from which a portion of iron is obtainable by proper fluxes; as the hyacinth and garnet. Geoffroy concludes from hence, that these stones really possess some medical virtues, depending upon their metallic part: but the quantity of metallic matter, sufficient to give them a considerable tinct, is so exceedingly small, and so inclosed in a stony matter not at all soluble by any of the known menstrua, as scarce to admit of any possibility of its acting in the human body.

Class 2. *Softer earths*; the talky, gypseous, and argillaceous.

THE talcs and gypsums have rarely been used as medicines. Some of the former, from their unctuous softness and silver hue, stand recommended externally as cosmetics; and some of the latter, on little better foundation, internally as astringents. But they have long been deservedly rejected by the judicious practitioners. They seem to possess the ill qualities of the alkaline earth (concreting with the mucus of the stomach, &c.), without any of their good ones.

Several of the clays, boles, and terræ sigillatæ, were highly celebrated by the ancients as astringents and alexipharmics, and some of them still continue in esteem; though it is certain they have no great claim to the virtues that have been attributed to them. Their real effects are, to give a greater degree of consistency to the fluids in the first passages, and in some measure defend the solids from their acrimony.

Most of these bodies contain, besides the tenacious indissoluble earth, which is their principal characteristic, (1.) A portion of an earth soluble in acids similar to those of the first section. (2.) Of acid, separable by distillation in a strong fire: this acid is always of the same nature with that obtained from vitriol, sulphur, and alum. (3.) The coloured ones contain likewise small quantities of iron, reducible, by inflammable fluxes, into its metallic form. In consequence of the first of these ingredients, these earths may be looked upon in some measure as absorbent: the acid appears to be united with a part of the absorbent earth into a saline compound, approaching to an aluminous nature; whence they have some degree of astringency:

Glutinous and Unctuous substances. Agency: whether they receive any peculiar virtue from the iron, is greatly to be doubted; since it is in a very crude state, and in quantity extremely small.

These earths unite with water into a turbid liquor, slippery and smooth to the touch, and remain for some time suspended; the sand, grit, or other grosser matters, which are often found naturally mingled with them, subsiding. They may be freed by means of acids from their alkaline earth; by coction in water, from their saline matter; and the coloured ones from their iron by digestion in aqua-regis, the only menstruum we are acquainted with that will extract the ferrugineous matter of argillaceous and bolar earths. This purified, they have all nearly the same appearance and qualities. Exposed to a strong fire, they lose their soft glutinous quality, and are reduced into hard masses, indissoluble as at first.

ART. IV. GLUTINOUS Vegetable and Animal Substances.

Class 1. Vegetable.

Pure gums:	Vegetables abounding with mucilage:
Tragacanth,	Orchis root,
Seneca,	Althaea root,
The gums of cherry, plum, and other European trees.	Quince-seeds, &c.

Gums and mucilages are glutinous vegetable productions, of no particular taste or smell, soluble in water, but not in vinous spirits or in oils. They differ from one another only in degree of tenacity; the more tenacious are called *gums*; those which are less so, *mucilages*. The first naturally exude from certain trees and shrubs; the latter are extracted by art. Almost all vegetable substances contain some portion of these, which, after the refinous part has been extracted by spirit, may be separated from the remaining matter by means of water.

The general virtues of these kinds of substances are, to thicken the fluids, and defend the solids from them when grown sharp or corrosive. Hence their use in a thin acrimonious state of the juices, and where the natural mucus of the intestines is abraded.

Class 2. Animal.

Most animal substances (the fat excepted) contain a viscid matter, in many respects similar to the foregoing, and capable of being extracted by strong coction in water.

Animal glues and gellies have the general qualities of the vegetable gums and mucilages; with this difference, that the former are more nutrimental, and apt to run into a putrid state. Considered as the subjects of chemistry, the difference betwixt them is very great: those of the animal kind are changed by fire into a volatile alkaline salt, and a fetid oil; the vegetable into an acid liquor, and a very small portion of oily matter, considerably less fetid than the former.

ART. V. Soft UNCTUOUS Substances.

Class 1. Insipid vegetable oils; and substances abounding with them; as almonds, and the kernels of most fruits; linseed, and the medullary part of sundry other seeds.

Class 2. Animal fats; as spermæti.

VOL. X. Part II.

UNCTUOUS vegetables unite with water, by trituration, into a milky liquor; and give out their oil upon expression.—These kinds of oils and animal-fats dissolve not in any menstruum except alkaline ones; which change their quality, and reduce them into a soap, dissoluble in water, but more perfectly in vinous spirits; from this compound, the oil may, by a skillful addition of acids, be recovered in a purer state than before, and rendered soluble, like essential oils, in spirit of wine.

The medical virtues of these substances are, to obtund acrimonious humours, and to soften and relax the solids; hence their use internally in tickling coughs, heat of urine, pains, and inflammations; and externally in tension and rigidity of particular parts. The milky solutions, commonly called *emulsions*, though much less emollient than the oils themselves or animal-fats, have this advantage, that they may be given in acute or inflammatory distempers, without danger of the ill consequences which the others might sometimes produce: fats and oils, kept in a degree of heat no greater than that of the human body, soon become rancid and acrimonious; whilst emulsions tend rather to grow sour.

ART. VI. ASTRINGENTS.

Galls,	Balaustines,
Tormentil-root,	Terra Japonica,
Bitroot-root,	Acacia, &c.

ASTRINGENT substances are distinguished by a rough austere taste; and changing solutions of iron, especially those made in the vitriolic acid, of a dark purple or black colour.

Astringents yield their virtues by infusion both to water and vinous spirits, generally in greatest perfection to the former. Oils extract nothing from them; nor do they give over any of their virtue in distillation: nevertheless their astringency is considerably abated by evaporating decoctions of them to the consistence of an extract, and totally destroyed by long keeping.

The medical effects of these kinds of substances are, to constringe the fibres, and incrassate or lightly thicken the juices. Their more experienced use is in disorders proceeding from a debility or flaccid state of the solids; in hæmorrhages, from a thinness of the blood, laxity or rupture of the vessels; in preternatural discharges of other kinds, after the offending matter has been duly corrected or evacuated; and in external relaxations.

In some cases, they produce the effects of astringents; the vessels, constricted and strengthened by them, being enabled to protrude the circulating juices with greater force.

A good deal of caution is requisite in the use of these medicines, especially those of the more powerful kind. In plethoric habits, inveterate obstructions, critical evacuations, and in all kinds of fluxes in general before the morbid matter has been expelled, or where there is any stricture or spasmodic contraction of the vessels, astringents prove eminently hurtful. Where critical dysenteries or diarrhæas are restrained by typtics, the acrimonious matter, now confined in the intestine, corrodes or enflames them; and sometimes occasions a gangrene of the parts.

ART. VII. SWEETS.

Sugar
Honey,Raisins,
Liquorice, &c.

The vegetable sweets are a very numerous tribe; almost every plant that has been examined, disclosing in some of its parts a saccharine juice. The bottoms of flowers, and most kinds of seeds and grain when they begin to vegetate, are remarkably sweet.

Vegetable sweets are extracted both by water and vinous spirits, most readily by the first, but in greatest perfection by the latter. Nothing of their taste arises in distillation with either of these liquors: nevertheless, by long boiling with water they become somewhat less agreeable; but are not much injured by being treated in the same manner with rectified spirit.

The purer sweets, as sugar, promote the union of distilled oils with watery liquors, and prevent the separation of the butyaceous part from milk: from this quality, they are supposed to unite the unctuous part of the food with the animal juices. Hence some have concluded, that they increase fat: others, that they have a contrary effect, by preventing the separation of the unctuous matter which forms the fat from the blood: and others, that they render the juices thicker and more sluggish, retard the circulation and cuticular excretion, and thus bring on a variety of disorders. But sweets have not been found to produce any of these effects in any remarkable degree: common experience shows, that their moderate, and even liberal, use is at least innocent; that they reconcile, not only to the palate, but to the stomach also, substances of themselves disgusting to both; and thus render salutary what would otherwise be injurious to the body.

The unctuous and mucilaginous sweets, as the impure sugars, liquorice, &c. have a considerable degree of emollient and lubricating virtue.—Those accompanied with a manifest acid, as in the juices of most sweet fruits, are remarkably relaxing; and if taken immoderately, occasion diarrhoeas and dysenteries, which sometimes have proved fatal.

ART. VIII. ACIDS.

ACIDS are substances of a penetrating pungency. Applied to the skin, they inflame or exulcerate it: chewed, they occasion a copious discharge of saliva: and snuffed up the nose, they provoke sneezing.

These substances, considered as the subjects of pharmacy, may be divided into three classes,

- Yielding their acrimony {
1. In distillation with water: as horse-radish, mustard, scurvy-grass, &c.
 2. By infusion only: as the greatercelandine, pyrethrum, &c.
 3. Neither to infusion, nor distillation: as arum and dracunculus.

The general effects of acid medicines are, to stimulate the vessels, and dissolve tenacious juices. In cold leucoplegmatic habits, stagnations of the fluids, and where the contractile power of the solids is weak, they prove powerful expectorants, deobstruents, diuretics, and emmenagogues; and if the patient is kept warm, sudorifics. In hot bilious constitutions, plethoric habits, inflammatory distempers, where there is al-

ready a degree of irritation, where the juices are too Aromatics and Bitters. thin or acrimonious, or the viscera unbound, these stimulating medicines prove highly prejudicial, and never fail to aggravate the disease.

Certain acid substances have been lately recommended in dry convulsive asthma: of the efficacy of the squill in particular, for the cure of this disorder, several instances are related in the *Commercium Literarium* of Norimberg for the years 1737 and 1739. Cartheuser thinks, that not the asthma itself, but a particular effect of it, was removed by this medicine. He observes, that in all asthmas the free circulation of the blood through the pulmonary vessels is impeded; and hence, during every paroxysm, the lungs are in a kind of oedematous state: that if this oedema, becoming habitual, remains after the fit is over, it is either perpetually occasioning fresh ones, or gives rise to a dropsy of the breast: that acid medicines, by removing the oedema, remove what was originally an effect of the asthma, and in time a cause of its aggravation.

ART. IX. AROMATICS.

AROMATICS are substances of a warm pungent taste, and a more or less fragrant smell. Some of the spices are purely aromatic, as cubebæ, pepper, cloves; some substances have a sweetness mixed with the aromatic matter, as angelica-root, aniseed, fennel-seed; some an astringency, as cinnamon; some a strong mucilage, as cassia lignea; some a bitterness, as orange-peel. The aromatic matter itself, contained in different subjects, differs also not a little in its pharmaceutical properties. It is extracted from all by rectified spirit of wine; from some in great part, from others scarcely at all, by water. The aromatic matter of some subjects, as of lemon-peel, rises wholly in distillation both with spirit and water; that of others, as cinnamon, rises wholly with water, but scarcely at all with spirit; while that of others, as pepper, is in part left behind after the distillation of water itself from the spice.

With regard to the general virtues of aromatics, they warm the stomach, and by degrees the whole habit; raise the pulse, and quicken the circulation. In cold languid cases, plegmatic habits, and a weak flaccid state of the solids, they support the vis vite, and promote the salutary secretions. In hot bilious temperaments, plethoric habits, inflammatory indispositions, dryness and strictures of the fibres, they are generally hurtful.

ART. X. BITTERS.

Gentian root,	Lesser centaury,
Hops,	Carduus, &c.

BITTERS for the most part yield their virtue both to watery and spirituous menstrua; some more perfectly to one, and others to the other. None of the substances of this class give over any thing considerable of their taste in distillation, either to water or to spirit; their bitterness remaining entire, and frequently improved, in the extracts. Such as are accompanied with flavour, as wormwood, may by this process be reduced into simple flavourless bitters.

These substances participate of the virtues of astringents and aromatics. Their general effects are, to constringe the fibres of the stomach and intestines, to warm the habit, attenuate the bile and juices in the

Emetics
and Cathar-
tics.

first passages, and promote the natural evacuations, particularly of sweat and urine. In weakness of the stomach, loss of appetite, indigestion, and the like disorders, proceeding from a laxity of the solids, or cold sluggish indispotion of the juices, these kinds of medicines do good service. Where the fibres are already too tense and rigid, where there is any immoderate heat or inflammation, bitters very sensibly increase the distemper; and, if their use is continued, communicate it to the kidneys: hence the urine becomes high-coloured, small in quantity, and at length suppressed; a dropy soon succeeding. If the kidneys were before so lax as to remain now uninjured, yet the other viscera become gradually more and more rigid, and a tabes is at length brought on.

Bitter substances destroy insects, and prevent putrefaction. Hence they are recommended as anthelmintic, and externally as antiseptics.

ART. XI. EMETICS AND CATHARTICS.

Hellebore,	Colocynth,
Julip,	Scammony,
Ipecacuanha,	Gamboge, &c.

These substances consist of a resinous part, in which the purgative or emetic quality resides: and a gummy saline one, which acts chiefly as a diuretic. The first is extracted or dissolved by vinous spirits; the latter by water. Nothing arises in distillation from either.

The acrid resins, exhibited by themselves, tenaciously adhere to the coats of the intestines, by their stimulating power irritate and inflame them, and thus produce sundry violent disorders. Hoffman relates, that he has sometimes observed convulsions, and a paralysis of both sides, from their use.

These inconveniences may be avoided, by previously triturating them with substances capable of dividing their tenacious texture, and preventing their adhesion; by this means they become mild and safe, operate without disturbance, and at the same time

more effectually answer the purposes intended by them.

Some have endeavoured to correct the ill quality of the resinous purgatives, by the addition of acids and aromatic oils. Acids weaken their power, but have no other effect than what a diminution of the dose would equally answer. The pungent essential oils may serve to warm the stomach, make the medicine sit easier, and thus prevent the nausea which sometimes happens; but as soon as the resin begins to exert itself in the intestines, these oils, instead of correcting, increase its virulence; being themselves apt to occasion the inconveniences which they are here intended to prevent, an irritation and inflammation of the bowels. Alkaline salts or soaps have a better effect; as they dispose the resin to solution, and promote its operation.

The medicines of this class seem to act by liquefying the juices, and stimulating the coats of the stomach and intestines. If the irritation is strong and sudden, their action is quick and upwards: if slower, downwards. Cathartics given in a liquid form, or in very sensible habits, often prove emetic; and emetics, where mucus abounds, cathartic. They operate more violently in robust constitutions than in those of a contrary temperament; the vessels being in the former more tense and rigid, and consequently less capable of bearing an equal degree of irritation.

The action of these medicines is extended beyond the prime viæ: This appears evident from the increase of the pulse which always accompanies their operation; and from the common observation of children being purged by the milk, if the nurse has taken a cathartic. Some of them, particularly hellebore, are said to purge, if only applied externally in issue.—Purgatives, even of the more powerful kind, exhibited in suitable small doses, in conjunction with the milder aperients, may be introduced into the habit, so as to prove notable deobstruents, diuretics, and diaphoretics, without acting sensibly by stool.

A CATALOGUE of the SIMPLES used in the MATERIA MEDICA, exhibiting at one view their TECHNICAL NAMES, ENGLISH NAMES, PARTS USED IN MEDICINE, VIRTUES, and the different PREPARATIONS FROM THEM.—A particular account of the different articles of this list is given in the course of the alphabet, chiefly under the Linnæan names: And the method of making the preparations from them are shown under the article PHARMACY. The notes subjoined at the bottom of the following pages are intended to supply some particulars relating to a few of the detached articles already past.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Abies ruber (<i>Pinus abies</i> , Lin.)	The fir-tree.	The wood, tops, and cones.	Diuretic and diaphoretic.	A decoction.
Abrotanum femina (<i>Santolin chama-cypar</i> , Lin.)	Lavender cotton.	The leaves.	Stimulant, detergent, and anthelmintic.	Decoction, and ointment for cutaneous eruptions.
Abrotanum mas (<i>Artemisia abrotanum</i> , Lin.)	Southernwood.	The leaves.	Stimulant, detergent, aperient, and sudorific.	Decoction and tincture; also lotion and ointment for cutaneous eruptions.
Abinthium maritimum (<i>Artemisia maritima</i> , Lin.)	Sea wormwood.	The tops.	Stomachic.	An oil, extract, conserve, and several distilled tincture-waters. They also enter the common fomentation and green oil.
Abinthium vulgare (<i>Artemisia absinthium</i> , Lin.)	Common worm-wood.	The leaves and flowering tops.	Stomachic.	

List of
Simples.

List of
Simples.

TECHNICAL NAMES. ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Acacia Germanica The floc. (<i>Prunus spinosa</i> , Lin.)	Inspissated juice.	Astringent.	
Acacia vera (<i>Mimosanilatica</i> , Lin.)	Inspissated juice.	Astringent.	
Acetofa (<i>Rumex acetof.</i> Lin.)	Leaves.	Astringent and antiscorbutic.	An effential salt for taking out spots in clothes. A decoction.
Acetofella (<i>Oxalis acetofel.</i> Lin.)	The leaves.	Astringent and antiscorbutic.	A conserve.
Acetum. Vinegar.		Cordial, refrigerant, sudorific, and antiseptic.	A distilled spirit.
Aconitum (<i>A. napellus</i> , Lin.)	The herb and leaves.	Narcotic.	Tincture.
Acorus. See <i>Callamus arom.</i> infra.			
Adiantum verum Maiden-hair. (<i>Adiant. capill. Ven.</i> Lin.)	The leaves.	Attenuating and aperient.	Decoction and syrup; its virtues best obtained from an infusion of the herb sweetened with sugar and liquorice, and drank as tea.
Aer dephlogisticus. Dephlogisticated air.		Supposed to be antiseptic and corroborative.	
Aer mephiticus. Fixed air.		Antiseptic and lithontriptic.	
Aer nitrosus. Nitrous air.		Very antiseptic.	
Æs. See <i>Cuprum</i> . Brass. See <i>Copper</i> .			
Agaricus, (<i>Boletus pini larici</i> , Lin.)	Agaric.	Cathartic.	An aqueous extract, but now much disused.
Agaricus chirurgorum (<i>Boletus ignarius</i> , Lin.)	Female agaric, or agaric of the oak, touchwood, or spunk.	Styptic.	Pieces applied externally.
Agnus castus (<i>Vitex agnus castus</i> , Lin.)	The chaste tree.	Antaphrodisiac.	
Agrimonia (<i>A. eupatoria</i> Lin.)	Agrimony.	Attenuant and tonic.	Digested in whey, it forms a diet-drink used by some in the spring.
Albumen ovi. White of an egg.		Discutient.	
Alchemilla (<i>A. vulgaris</i> , Lin.)	Ladies-mantle.	Astringent.	
Alkekengi, (<i>Physalis alkekengi</i> , Lin.)	Winter-cherry.	Aperient and diuretic.	Dried and powdered. Inspissated juice.
Alliaria (<i>Erythimum alliaria</i> , Lin.)	Sauce-alone, or Jack-by-the-hedge.	Sudorific and deobstruent.	
Allium (<i>A. sativum</i> , Lin.)	Garlic.	Stimulant, attenuant, discutient, and diuretic.	A syrup and oxymel, ointment and poultice.
Alnus (<i>Betula alnus</i> , Lin.)	Alder.	Astringent.	Decoction. The leaves chopt and heated, efficacious for dispersing milk in the breasts.
Aloes (<i>Aloe perfoliata</i> , Lin.)	Aloes.	Cathartic.	Ingredient in several tinctures and pills.
Alfina (<i>A. med.</i> Lin.)	Chickweed.	Refrigerant.	

List of Simples.	TECHNICAL NAMES. ENGLISH NAMES.		PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	List of Simples.
	Althea (<i>A. officina- lis</i> , Lin.)	Marshmallow.	The leaf and root.	Emollient.	A syrup and ointment.	
	Alumena.	Alum.	The whole.	Strongly astringent.	A styptic powder, styptic wa- ter, whey, &c.	
	Ambragrisea.	Ambergrise.	The whole.	A high cordial.	A tincture or essence.	
	Ammi vulgaris.	Bishop's weed.	The leaves.	Stimulant.	An ingredient in the theriaca.	
	Amomum verum.	True amomum.	The seeds.	Aromatic.	An ingredient in the theriaca.	
	Amomum vulgare (<i>Sison</i> , Lin.)	Bastard stone-par- sley.	The seeds.	Carminative and diuretic.		
	Ammoniacum. See Gummi.					
	Amygdala (<i>Am. con.</i> Lin.)	Sweet and bitter al- monds.	The fruit.	Relaxing.	Expressed oil and emulsion.	
	Amylum.	Starch.		Astringent.		
	Anacardium occi- dentale, (Lin.)	Cashew-tree.	The nuts.	Corrosive.	Oil outside, but the kernels used as almonds; the gum instead of gum arabic.	
	Anagallis (<i>Arven- sis</i> , Lin.)	Pimpernel.	The leaves.	Sudorific and nerve- vine.	Extract, or inspissated juice.	
	Ananas (<i>Bromelia ananas</i> , Lin.)	The pine-apple.	The fruit.	Refrigerant.		
	Anchusa (<i>A. tinc- toria</i> , Lin.)	Alkanet.	The root.	Only used for its colour.		
	Anethum (<i>A. gra- veolens</i> , Lin.)	Dill.	The seeds.	Carminative.	Distilled oil, water, and spi- rituous extract.	
	Angelica (<i>A. Arch- angelica</i> , and <i>syl- vestris</i> , Lin.)	Angelica.	The roots, stalks, leaves, and seeds.	Aromatic.	Several compound waters.	
	Angusturæ cor- tex, (A)					
	Anisum (<i>Pimpin- ella anisum</i> , Lin.)	Anise.	The seed.	Aromatic and to- nic.	An essential oil, a spirituous compound water, &c.	
	Antimonium.	Antimony.		Diaphoretic, cat- hartic, emetic, or caustic.	A number of chemical prepa- rations. See CHEMISTRY- Index, KERMES Mineral, and REGULUS of Antimony.	
	Aparine (<i>Gallium aparine</i> , Lin.)	Goosegrass, or cli- vers.	The leaves.	Aperient.		
	Apium (<i>A. gra- veol.</i> Lin.)	Smallage.	The roots, leaves, and seeds.	Carminative.	Diet-drinks.	
	Aqua marina.	Sea-water.		Cathartic and alte- rative.		
	Aquæ minerales.	Mineral waters.		Tonic and altera- tive.		
	Aquæ sulphuræ.	Sulphureous wa- ters.		Alterative and au- thelmintic.		
	Argentina (<i>Po- tentilla argentin.</i> Lin.)	Silverweed.	The leaves.	Corroborant.		
	Argentum vivum.	Quicksilver.		A most powerful alterant.	Several chemical prepa- rations; see CHEMISTRY- Index. An ingredient in se- veral other official prepa- rations.	

Aristo-

Aristo-

(A) The Angustura bark was first imported from the West Indies in 1788; but it is a native of Africa. Mr Bruce, who had been cured of a dysentery in Abyssinia by the bark of a plant called there *Wogginas*, brought the seeds from that country, and the plant is now cultivated in Kew garden and other places under the name of *Brucea antidyenteria*, or *ferruginea*. He supposed the bark of this was the same with that of the Angustura; but Dr Duncan, in the Medical Commentaries for 1790, says that they are totally different when compared together. For an account of the Angustura bark, see *Jesuit's Bark*.

List of Simples.					List of Simples.
	TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
	<i>Aristolochia</i> (<i>A. clematitis</i> , Lin.)	Birthwort.	The roots.	Attenuating, stimulant, and detergent.	
	<i>Armeniaca</i> (<i>Prunus Armeniaca</i> , Lin.)	The plum-tree.	The fruit and gum.	The fruit refrigerant, and the gum demulcent.	
	<i>Arnica</i> (<i>A. montana</i> , Lin.)	German leopard's bane.	The herb, flowers, and roots.	Antispasmodic; emetic, cathartic.	A warm infusion.
	<i>Arsenicum</i> (a)	Arsenic.		Corrosive.	
	<i>Artemisia</i> (<i>A. vulgaris</i> , Lin.)	Mugwort.	The leaves.	Antispasmodic.	Infusion.
	<i>Arum</i> (<i>A. maculatum</i> , Lin.)	Wake-robin.	The root.	Stimulant.	A compound powder and conserve (c).
	<i>Afafetida</i> . See <i>Gummi, infra</i> .				
	<i>Afarum</i> (<i>A. Europaeum</i> , Lin.)	Afarabacca.	The leaves.	Errhine, cathartic and emetic.	A compound powder (p)
	<i>Aparagus</i> (<i>A. officinalis</i> , Lin.)	Alparagus.	The roots.	Supposed diuretic, but uncertain.	
	<i>Aperula</i> .	Woodruff.	The flowers.	Attenuant and aperient.	

Asphodelus,

(b) This pernicious mineral has some time ago been introduced into medicine as a certain remedy for cancers; but Mr Justamond, who published a treatise on this subject two or three years ago, informs us, that even the most guarded use of it in the external way, while it produces the happiest effects in healing cancerous ulcers, yet occasions such disagreeable symptoms of the paralytic kind, that it cannot be perfited in. The latest trials in London are likewise said to confirm this account; notwithstanding which, however, the internal use of it has since gained ground in a variety of disorders, particularly in intermitting fevers, which are said to be readily cured by it sometimes after the bark and all other remedies had failed. A solution of the mineral is given by drops, from one sixteenth to a sixth part of a grain for a dose, largely diluted in a warm aqueous liquid. Dr Aikin recommends oil and milk as a certain remedy against this destructive poison. He quotes from Hoffman an instance where several persons of distinction had tasted food mixed with arsenic instead of sugar. All of them were seized with anxiety at the breast, pain at the stomach, tremor of the lips, and reachings. Milk and oil were given in great plenty, and they continued strongly vomiting for half a day. Some vomited no less than 100 times; but all of them recovered. Some instances of a similar kind have come within the Doctor's own knowledge. Sage in his Mineralogy relates, that the regulus is much less dangerous than the calx or glafs: he says that on giving half an ounce to a cat, the animal only grew meagre for some time, but afterwards became fat again. He says that acids, particularly vinegar, are the antidotes to this poison; and that oils and emulsions do not so effectually obtund this poison as acids do. Of this he has had experience in brutes. He adds, that the regulus is not soluble in water, and that the founders are more afraid of fumes of lead than arsenic.

(c) Dr Aikin informs us, that the insupportable pungeny on the tongue, which has hitherto prevented it from being used in a fresh state so as to exert its full virtues, is effectually covered by unctuous and gummy materials. The fresh root beaten into a smooth mass, with the addition of a little testaceous powder which promotes the division of it, may be either mixed with about an equal quantity of powdered gum arabic, and three or four times as much conserve, so as to make them into an electuary; or rubbed with a thick mixture of mucilage of gum arabic and spermaceti, gradually adding any suitable watery liquors, and a little syrup in order to form an emulsion, two parts of the root, two of gum, and one of spermaceti, make an emulsion, which scarce impresses any degree of pungeny upon the tongue though kept long in the mouth. In these forms our author has given the fresh root from ten grains to more than a scruple, three or four times a-day: it generally occasioned a slight sensation of warmth, first about the stomach and then in the remoter parts; manifestly promoted perspiration, and frequently produced a plentiful sweat. Several obstinate rheumatic pains have been removed by the use of this preparation, which our author therefore recommends to further trial.

(d) The leaves of this plant are by some supposed to be more powerful than the roots as emetics and cathartics, but they are milder as errhines. Geoffroy relates, that a single dose of the errhine of which this root is an ingredient has occasioned a discharge for three days; and that he has known a palsy of the mouth and tongue cured by the same means. He recommends it in stubborn disorders of the head proceeding from viscid matters, in palsies, and lethargic distempers. During its operation the patient must carefully avoid cold; which is apt to produce pultules, inflammations, swellings of the face, and sometimes worse symptoms than even these. The empirical herb-snuffs have the leaves of afarum for their basis, but sometimes mixed with ingredients of a more dangerous nature.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
<i>Aphodelus</i> , (<i>A. Aphodel</i> , or king's <i>peplus</i> , Lin.)	pear.	The roots.	Emollient and suppurative.	
<i>Atriplex</i> (<i>Cheopodium vulvar</i> , Lin.)	Stinking orach.	The leaves.	Antispasmodic.	A spirituous tincture, decoction, or conserve, recommended by Tournefort and others.
<i>Avena fativa</i> (Lin.)	Oats.	The grain.	Emollient.	Decoction.
<i>Aura electrica</i> .	Electricity.		A violent stimulant.	
<i>Aurantium</i> (<i>Citrus aurant</i> , Lin.)	The orange.	The leaves, fruit, and flowers.	Cordial, stomachic, and refrigerant.	An essential oil, a distilled water, and a conserve.
<i>Auricula</i> Judæ, Jews-ears. (<i>Tremell. verruc</i> , Lin.)		The whole.	Purgative, or astringent; uncertain.	
<i>Auripigmentum</i> .	Orpiment.		Corrosive, but less so than arsenic.	
<i>Axungia porcina</i> .	Hog's lard. }		Emollient.	
<i>Axungia viperina</i> .	Viper's fat. }			
<i>Balaustia</i> (<i>Punica granat</i> , Lin.)	Balaustine, or double-flowered pomegranate tree.	The flowers.	Astringent.	Ingredient in a powder.
<i>Balsamita</i> (<i>Tanacetum balsaminum</i> , Lin.)	Costmary.	The leaves.	Aromatic, antihysteric.	Distilled water and spirituous tincture.
<i>Balsamum Canadense</i> (<i>Pinus balsamea</i> , Lin.)	Balsam of Canada.	The rosin.	Diuretic and tonic.	
<i>Balsamum Copayve</i> (<i>Copaifera officinalis</i> , Lin.)	Balsam of Copivi.	The rosin.	Diuretic and tonic.	An empyreumatic oil, and an ingredient in some tinctures (z).
<i>Balsamum Gileadense</i> (<i>Amyris Gileadensis</i> , Lin.)	Opobalsam, or balm of Gilead.	The rosin.	Said to be a most extraordinary vulnerary.	
<i>Balsamum Peruvianum</i> (<i>Myroxylon peruiferum</i> , Lin.)	Balsam of Peru.	The rosin.	A fine warm aromatic.	An ingredient in many tinctures, and some ointments.
<i>Balsamum Toluianum</i> (<i>Toluifera balsaminum</i> , Lin.)	Balsam of Tolu.	The rosin.	Aromatic and corroborant.	An ingredient in several tinctures, elixirs, and a kind of pectoral pills.
<i>Bardana</i> major, (<i>Arctium lappa</i> , Lin.)	Burdock.	The roots and seeds.	Aperient, diuretic, and sudorific.	Decoction.
<i>Barytes</i> (r).				

Beccabunga,

(z) Balsam of Copivi has been employed empirically in hemorrhoidal cases; and Dr Cullen informs us, that he has known it give relief in such cases, in doses from 20 to 40 drops once or twice a day, mixed with powdered sugar. Fuller recommends it in consumptions; but his practice is censured by Dr Fothergill in the 4th volume of London Medical Observations.

(r) *Barytes*. The solution of the aerated barytes, or terra ponderosa, in spirit of salt, has been found capable of producing powerful effects on the human system. Several trials of it were made in the year 1789 by Dr Crawford, in St Thomas's hospital; and it was found to be very efficacious in scrophulous complaints. — In some cases of swelled glands, foul ulcers, enlarged joints, and general cachexy, singular relief was given by the muriated barytes, either alone or joined with mercurials, antimonials, and the bark. The medicine in a few cases appeared to augment the cuticular secretion; in most it occasioned an uncommon flow of urine, and almost universally improved the appetite and general health of the body. Few stomachs, however, could bear more than from six to ten drops of a saturated solution, nor did a continued use of the medicine reconcile the stomach to it, but rather the contrary. Sometimes it produced a vertigo, which probably arose from its nauseating quality. Dr Crawford is of opinion, that this solution, when injudiciously managed, is capable of producing deleterious effects, by disordering the nervous system, and bringing on violent vomiting and purging; From some experiments made upon dogs, it appears that a large dose would prove fatal.

List of
Simples.List of
Simples.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Beccabunga (<i>Vernonia beccabunga</i> , Lin.)	Brooklime.	The herb.	Attenuating, and antiscorbutic.	
Bechen album, (<i>Centaurea bechen</i> , Lin.)		The root.	Stimulant.	
Bechen rubrum, (<i>Statice limon</i> , Lin.)		The root.	Stimulant.	
Belladonna (<i>Atropa belladonna</i> , Lin.)	Deadly nightshade.	The juice,	Narcotic.	An extract of the juice, decoction, infusion, powders.
Bellis minor, (<i>Bell. peren</i> , Lin.)	Common daisy.	The leaves.	Attenuant.	
Benzöe, (<i>Terminalia benzoin</i> , Lin.)	Benzoin.	The resin.	Pectoral.	Ingredient in the paregoric elixir.
Beberis (<i>Berber. vulgar</i> , Lin.)	Barberry.	The bark and fruit.	Astringent.	A jelly.
Beta, (<i>B. vulgaris</i> , Lin.)	The beet.	The root and leaves.	Cathartic and em- rhine.	
Betonica (<i>B. officinalis</i> , Lin.)	Betony.	The leaves and flowers.	Corroborant.	
Betula (<i>B. alba</i> , Lin.)	The birch-tree.	The bark and sap.	Antiscorbutic and diuretic.	
Bezoar.	Bezoar-stone.		Many virtues falsely ascribed to it; now found to be only an absorbent.	
Bilis animalis.	The gall or bile of animals.		Cathartic.	
Biftorta (<i>Polygonum bistorta</i> , Lin.)	Biftort or snake-wort.	The roots.	Powerfully astringent.	An ingredient in a powder.
Boli.	Boles.		Astringent and slightly absorbent.	Ingredients in several powders.
Bonus Henricus, (<i>Chenopodium bonus Hen</i> , Lin.)	English mercury, all-good, or good Henry.	The leaves.	Laxative.	
Borax.	Tincal, or borax.	The whole.	Diuretic and emmenagogue.	An ingredient in a powder, and a salt prepared from it. See CHEMISTRY-Index.
Branca urfina, (<i>Acanthus mollis</i> , Lin.)	Bear's-breech.	The root.	Emollient.	
Brassica, (<i>B. oleracea</i> , Lin.)	Cabbage.	The leaves.	Refrigerant and laxative.	
Brassica marina, (<i>Corvolvulus foldanella</i> , Lin.)	Sea-coleworts, or foldanella.	The leaves.	A strong cathartic.	Now rejected from practice.
Brucea antidysenterica. See note (A), <i>supra</i> .				
Bryonia (<i>B. alba</i> , Lin.)	White briony.	The root.	Discutient and violently cathartic.	
Burfa pastoris, (<i>Thlaspi burfa</i> , p. Lin.)	Shepherd's purse.	The leaves.	Astringent, but very doubtful.	
Cacao (<i>Theobroma cacao</i> , Lin.)	Chocolate tree.	The fruit.	Analeptic.	Chocolate.
Cajeput (<i>Maleleuca leucandendron</i> , Lin.)	Cajeput.	The fruit.	Stimulant, healing, carminative.	Distilled oil.

List of
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TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Calaminaris lapis.	Calamine stone.		Defecative, healing.	An ingredient in collyria, epulotic cerate, &c.
Calamintha (<i>Meliss. fa calamintha</i> , Lin.)	Calamint.	The leaves.	Aromatic and stimulant.	
Calamus aromaticus (<i>acorus calamus</i> , Lin.)	Sweet-flag.	The roots.	Aromatic and stomatic.	
Calendula (<i>C. officinalis</i> , Lin.)	Garden marigold.	The flowers.	Attenuating and sudorific, but very doubtful.	
Calx viva.	Quicklime.		A violent corrosive, and powerful alterant and absorbent.	A medicated water.
Camphor (<i>Laurus camphora</i> , Lin.)	Camphire tree.	The concreted essential oil.	Refrigerant and diaphoretic, stimulant, antispasmodic.	A solution in rectified spirit, in expressed and essential oils. Ingredient in many other compositions.
Canella alba (Lin.)	White cinnamon.	The bark.	Aromatic and stimulating.	An ingredient in several tinctures.
Cannabis (<i>C. sativa</i> , Lin.)	Hemp.	The seeds.	Aperient and refrigerant, but doubtful.	Decoctions and infusions.
Cantharis (<i>Meloe vesicatorius</i> , Lin.)	Spanish fly.		Violently stimulating and vesicatory.	A spirituous tincture, a plaster, ointment, &c.
Caparis (<i>C. spinosa</i> , Lin.)	Caper-bush.	The bark of the root, and flower-buds.	Aperient and stomatic.	Pickled.
Cardamines (<i>C. pratensis</i> , Lin.)	Cardamine.	The flowers.	Antispasmodic.	Powder.
Cardamomum majus (<i>Amom. cardam.</i> Lin.)	Greater cardamom.	The seeds.	Aromatic and stimulant.	} A spirituous water and tincture. Ingredient also in several official compositions.
Cardamomum minus (<i>Amom. repens</i> , Lin.)	Lesser cardamom.	The seeds.	Aromatic and stimulant.	
Cardiaca (<i>Leonurus cardiaca</i> , Lin.)	Mother-wort.	The leaves.	Antispasmodic.	
Carduus benedictus (<i>Gentiana benedicta</i> , Lin.)	Blessed-thistle.	The leaves and seed.	Stomachic.	An ingredient in a stomatic tincture. Infusions.
Carica (<i>Ficus carica</i> , Lin.)	The fig.	The dried fruit.	Emollient, suppurative.	Ingredient in the pectoral decoction and lenitive electuary.
Carlina (<i>C. acaulis</i> , Lin.)	Carlina-thistle.	The root.	Diaphoretic.	
Carpobalsam (<i>Amyris Gileadensis</i> , Lin.)	Carpobalsam.	The fruit.	Aromatic.	In substance applied warm as a cataplasm.
Carthamus (<i>C. tinctorius</i> , Lin.)	Barbary saffron.	The seeds.	Cathartic.	
Carvi (<i>Carum carvi</i> , Lin.)	Caraway.	The seeds.	Aromatic.	An essential oil, a spirituous water. Ingredient also in some official compositions.
Caryophylla rubra (<i>Dianthus caryoph.</i> Lin.)	Clove july-flower.	The flowers.	Cardiac and alexipharmac.	A syrup.

List of
Simples.List of
Simples.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Caryophyllata, (C. <i>um urban.</i> Lin.)	Avens, or herb benet.	The root.	Aromatic.	An essential oil.
Caryophyllum (C. <i>aromaticus</i> , Lin.)	The clove-tree.	The flower-cups.	Strongly aromatic.	An essential oil. Ingredient also in many official compositions
Cascarilla (C. <i>cafar</i> , Lin. <i>Croton eluteria</i> , Swartz Prodr.)	Cascarilla.	The bark.	Aromatic and stimulant.	Infusions.
Cassia fistularis (C. <i>stula</i> , Lin.)	Cassia.	The fruit.	Purgative.	An ingredient in two electuaries.
Cassia lignea (L. <i>rus cassia</i> , Lin.)	Cassia.	The bark and flower-buds.	Aromatic.	The basis of a distilled water.
Cassumunar.	Cassumar.	The root.	Stomachic and carminative.	
Castoreum (C. <i>stor fiber</i> , Lin.)	Castor.		Nervine and antispasmodic.	A simple water; a spirituous water; a tincture. Ingredient in several official compositions.
Catechu (M. <i>sa catechu</i> , Lin.)	Catechu, <i>vulgo</i> Japan earth.		Astringent.	A tincture, troches, and confection, and an ingredient in several official compositions.
Celery (A. <i>graculens</i> , Lin.)	Celery.	The leaves.	Laxative.	
Centaurium majus (C. <i>tauracentauryum</i> , Lin.)	Greater centaury.	The root.	Astringent, aperient, and vulnerary.	
Centaurium minus (C. <i>tiana centaury</i> , Lin.)	Lesser centaury.	The tops.	Stomachic.	Tincture and infusion.
Cepa (A. <i>um cepa</i> , Lin.)	The onion.	The root.	Attenuating and diuretic.	
Cera alba.	White wax.		Emollient.	Ingredient in many plasters and ointments.
Cera flava.	Yellow wax.		Emollient.	Ingredient in almost all ointments.
Cerasus (P. <i>rus cerasus</i> , Lin.)	The cherry tree.	The fruit and gum.	Refrigerant; the gum partaking of the properties of gum-arabic.	
Cerefolium (S. <i>andis cerefol</i> , Lin.)	Chervil.	The juice.	Aperient and diuretic.	
Ceterach (A. <i>plen-ceterach</i> , Lin.)	Spleenwort.	The leaves.	Diuretic (g).	
Cevadilla (V. <i>eratrum album</i> , Lin. ?)	Indian caustic barley.	The seeds.	Virulently caustic, (h).	
Chamaedrys (T. <i>crium chamaedr</i> , Lin.)	Germander.	The leaves and tops with the seed.	Sudorific, diuretic, &c.	

Chamæmelum

(c) M. Morand relates, that these leaves have lately been discovered to have an admirable diuretic virtue; that they were used with great success by Count d'Auteuil, a Spanish naval commander, for the gravel, with which he was violently tormented; and since that time they have come greatly into use at Paris, Verdun, and Grenoble. From observations made in those places it appears, that they carry off sand, cleanse the kidneys, and mitigate pains in the urinary passages; that the method of using them is to drink infusions of the leaves in the morning at tea, adding such other medicines as may be judged proper.

(h) These seeds appear to be the strongest of all vegetable caustics. Monardes relates, that in putrid ven-

minous.

List of Simples.	TECHNICAL NAMES. ENGLISH NAMES.		PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	List of Simples.
	Chamæmelum (<i>An- themis nobilis</i> , Lin.)	Camomile.	The single flowers.	Stomachic, carmi- native, and emol- lient.	An essential oil, a simple wa- ter, an extract, a decoct- tion.	
	Chamæpithys (<i>Teu- trium chamæpit.</i> Lin.)	Ground-pinc.	The leaves.	Aperient and vul- nerary.		
	Chelid. seu Leuco- jum luteum (<i>Chel- idonium cheiri</i> , Lin.)	Wallflower.	The flower.	Aperient, cordial, and attenuant.		
	Chelæ crancorum.	Crab's claws.		Absorbent.	Levigated.	
	Chelidonium majus, (Lin.)	Commoncelandine.	The leaves and roots.	Stimulating, diure- tic, and fudorific.	Infusion. Dried root pow- dered.	
	Chelidonium minus (<i>Ranunculus fici- ria</i> , Lin.)	Pilewort.	The leaves and root.	Emollient.		
	China (<i>Smilax Chi- na</i> , Lin.)	China.	The root.	Diaphoretic and diuretic.		
	Ciccer (<i>C. arietin.</i> Lin.)	Redchices, or chick peas.	The seeds.	Lithontripic and diuretic, but very doubtful.		
	Cichorium (<i>C. in- tyb.</i> Lin.)	Wild succory.	The roots and leaves.	Laxative and anti- scorbutic.		
	Cicuta major (<i>Co- nium maculat.</i> Lin.)	Hemlock (†).	The leaves and seeds.	Resolvent and alte- rant.	Inspissated juice of the leaves, and an extract from the seeds.	

minous ulcers and gangrenes, they have the same effects as corrosive sublimate, or the actual cautery; and that the way of using them is to sprinkle a little of powdered seed upon the part; or, for the greater safety, to dilute it with watery liquors, and apply lint dipped in the mixture. In the *Amanitates Academicæ* of Linneus, they are said to be the most powerful of all medicines for destroying cutaneous insects in children.

(†) It is supposed that the juice of this plant was the poison so much used among the Athenians for putting criminals to death; but from some late experiments this seems to be doubtful; or at least that the remedy is very easy. Mr Haram, apothecary at Chartres, informs us, that a large spoonful of the juice given to a cat had no sensible effect; a second produced a visible *embarras* on the region of the reins: in a little time the animal staggered, but did not fall. A quarter of an hour after, she was found stretched out motionless, with her paws rigid. Half a drachm of theriaca, with two large spoonfuls of wine, were given without effect: but no sooner was a large spoonful of lemon-juice swallowed than she got up as if nothing had happened, and continued afterwards in good health. Other authors likewise inform us, that vinegar is an antidote against the poisonous effects of this plant.

With regard to its medical virtues, Dr Monro, who has seen it tried in a great number of cases, informs us, that he never saw it cure a confirmed cancer, whether ulcerated or not; that in a few cases of ulcerated cancers it mended the discharge, and changed it from a thin ichor to an appearance of laudable pus; but, notwithstanding this favourable appearance, the distemper at last terminated fatally.—In scrophulous cases, some few small tumours were thought to be dissolved by it; but large hard swellings were never removed by it, tho' the remedy was continued for weeks and months. The discharge from scrophulous fores of the extremities, however, was often mended by it; and in many cases, it was found to be of more service when joined with the bark than when given alone: the action of the bark and mercury was thought to be rendered more powerful by it. In the chincoough it did not produce any remarkable effects. In some few instances, he imagined that it hurt the health of the patients; and in one or two, that it hastened death. In this last case, indeed, the use of the cicuta had been laid aside for some time, and the patients sunk so gradually, that our author was in doubt what might have been the cause of their death.

The roots of hemlock have been supposed to be more active than the leaves, both when taken internally and when outwardly applied. Dr Storck relates, that on being cut, it yields a bitter acrid milk, of which a drop or two applied to the tip of the tongue occasioned a rigidity, pain, and swelling of the part, so as to deprive him of the power of speech. These symptoms, however, disappeared on washing the part with citron juice. When dried, it loses its virulence; so that Dr Storck says, he has taken a grain or two of the powder without injury. Other authors give instances where 20 and 30 grains have been given with good effect in schirrosities of the liver, quartan agues, on the approach of a fit, and even in acute fevers. Dr Aikin informs us, that the fresh root seems not to be at all times of equal virulence; and that he has seen it chewed freely without

List of Samples.	TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	List of Samples.
	<i>Cinara</i> (<i>Cynara fo-</i> <i>lymus</i> , Lin.)	Artichoke.	The leaves.	Diuretic (κ).		
	<i>Cinnamomum</i> (<i>Laurus cinnam.</i> Lin.)	The cinnamon tree.	The bark.	Aromatic and cor- roborant.	An essential oil, a simple and spirituous distilled water, and an ingredient in a great number of compositions.	
	<i>Citrullus</i> (<i>Cucurbita</i> <i>citrullus</i> , Lin.)	Citruls.	The seeds.	Refrigerant.		
	<i>Coccinella</i> (<i>Coccus</i> <i>cacti</i> , Lin.)	Cochineal.		Sudorific, but chief- ly used for co- louring.		
	<i>Cocculus Indicus</i> , (<i>Menisperm. co-</i> <i>cul.</i> Lin.)	Indian berry.	The fruit.	Narcotic.		
	<i>Cochlearia</i> (<i>C. of-</i> <i>ficialis</i> , Lin.)	Scurvy-grass.	The leaves.	Stimulating and attenuant.	A conserve and spirit. An in- gredient in some other offi- cial preparations.	
	<i>Coffea</i> (<i>C. Arabica</i> , Lin.)	The coffee-tree.	The fruit.	Stomachic and cor- roborant.	A decoction.	
	<i>Colchicum</i> (<i>C. au-</i> <i>tumnale</i> , Lin.)	Meadow saffron.	The root.	Diuretic.	A syrup and oxymel.	
	<i>Colocynthis</i> (<i>Cucu-</i> <i>mis colocynthis</i> , Lin.)	Coloquintida, or bitter-apple.	The medullary part of the dried fruit.	Violently cathartic.	An ingredient in some cathar- tic pills and extracts.	
	<i>Columbo</i> (<i>Ignatia</i> <i>amara</i> , Lin.)	Columbo, or Co- lomba.	The root.	A most excellent antiseptic and stomachic.	A vinous tincture.	
	<i>Conessi</i> (<i>Nerium</i> <i>antidysentericum</i> , Lin.)	Conessi.	The bark.	Antiseptic and tonic (λ).		
	<i>Consolida major</i> , (<i>Symphitum offi-</i> <i>cin.</i> Lin.)	Comfrey.	The root.	Emollient.		

Contrayerva

without any other effect than that sweetishness observable in parsley roots or carrots. There are likewise instances, where the cicuta roots have been taken to the quantity of some drachms, or even ounces, without any bad consequence.

The seeds have been recommended as demulcent, pargoric, and antaphrodisiac; but little more (according to Dr Aikin) is yet known about them, but that they are innocent to some birds. Mr Ray says, that he found the crop of a thrush full of them, and that at a season when the corn was in full growth.

In the first volume of the Medical Commentaries, an extract prepared from hemlock-seeds is preferred to that made from the leaves; and in the last Edinburgh Pharmacopoeia, an extract of this kind is ordered as an official.

(κ) Dr Aikin informs us, that the expressed juice of the leaves has sometimes proved successful in dropries, when other remedies had failed. For this purpose it is not depurated, but only freed by passing through a strainer from the grosser feculencies, and mixed with an equal quantity of white wine; three or four spoonfuls to be taken every morning and evening.—The following decoction (as we are informed by Dr Monro) was long kept a secret by a person at Andover, and is said to have carried off the water from several people labouring under a dropfy. Take of artichoke leaves and stalks three handfuls; of bruised juniper-berries one quart; of scraped horse-raddish one handful; of green fir-tops two handfuls; of bruised white mustard-seed two table-spoonfuls; mix the whole, and boil them in two gallons of water to one, and strain the whole thro' a cloth. Half a pint to be taken by a grown person morning and evening, adding a little syrup or sugar to make it agreeable.

(λ) This bark is reckoned a specific in diarrhœas; the fine powder being made use of in an electuary formed with syrup of oranges, and given to the quantity of half a drachm or more four times a day, after a vomit has been given. The first day it is taken, the number of stools is generally increased, without any increase of the griping; the second, the colour of the stools is meliorated; and, on the third or fourth, the consistence approaches to the natural, when it makes a cure. It seldom fails in curing a recent diarrhœa, proceeding from irregularities in diet without fever; and it is frequently of service in habitual diarrhœas.

Kind of Simples.	TECHNICAL NAMES. ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	Kind of Simples.
	Contrayerva (<i>Dor- stenia contrayerva</i> , Lin.)	The root.	Aromatic and dia- phoretic.	Spirituos tincture, extract, powder.	
	Convallaria (<i>C. Po- lygonatum</i> , Lin.)	The root.	Suppurative.	Poultice, decoction in milk recommended in some cases of hemorrhagy.	
	Corallina (<i>Sertula- ria</i> , Lin.)	Coralline.	Absorbent.		
	Coriandrum (<i>C. fa- ticum</i> , Lin.)	The seeds.	Carminative and stomachic.	Formerly an ingredient in some officinal compositions.	
	Cornu cervi (<i>Cer- vus elephas</i> , Lin.)	Hartshorn.	Emollient and nu- tritious.	Shavings, a jelly, a volatile al- kaline salt and spirit, and an empyreumatic oil.	
	Costus (<i>C. Arab.</i> Lin.)	Costus.	The root.	Attenuant and diu- retic.	
	Craffula (<i>Sedum te- lephium</i> , Lin.)	Lesser orpine.	The leaves.	Emollient and af- tringent.	
	Creta alba.	White chalk.		Absorbent.	
	Crithmum (<i>C. ma- ritimum</i> , Lin.)	Samphire.	The leaves.	Aperient, stoma- chic, and diu- retic.	
	Crocus (<i>C. sativus</i> offic. Lin.)	Saffron.	The chives, or fleshy capilla- ments growing at the end of the flower.	Aromatic and cor- dial.	A spirituos tincture; a sy- rup; and an ingredient in several officinal compo- sitions.
	Croton. See <i>Caf- carilla supra</i> .				
	Cubebe (<i>Piper cu- beba</i> , Lin.)	Cubebs.	The fruit.	Aromatic and sti- mulant.	An ingredient in several offi- cinal compositions.
	Cucumis hortensis (<i>C. sativus</i> , Lin.)	The garden cucum- ber.	The seeds.	Refrigerant.	
	Cucumis agrestis (<i>Momordica ela- terium</i> , Lin.)	Wild cucumber.	The fruit.	Violently cathartic.	The juice inspissated.
	Cucurbita (<i>C. pepo</i> , Lin.)	The gourd and pumpion.	The seeds.	Refrigerating.	An expressed oil.
	Cuminum (<i>C. cymi- num</i> , Lin.)	Cummin.	The seed.	Aromatic, stimu- lant.	An essential oil by distilla- tion; and giving name to a plaster and cataplasm.
	Cupressus.	The cypress.	The fruit.	A strong astrin- gent.	
	Cuprum.	Copper.		A violent emetic, diuretic, and al- terative.	Calcined, and producing salts by combination with feve- ral acids, and with volatile alkali. See CHEMISTRY, Index.
	Curcuma (<i>C. longa</i> , Lin.)	Turmeric.	The root.	Aromatic, aper- ient, and emme- nagogue.	
	Cursuta (<i>Gentiana purpurea</i> , Lin.)		The root.	Stomachic.	
	Cydonium (<i>Pirus cydonia</i> , Lin.)	The quince.	The fruit and seeds.	Stomachic and cor- rosorative.	A syrup and jelly of the fruit, and mucilage of the seeds.
	Cyminum. See <i>Cu- minum supra</i> .				
	Cynoglossus (<i>C. of- ficialis</i> , Lin.)	Hound's tongue.	The root.	Narcotic, but doubtful.	
	Cynosbatum (<i>Rosa canina</i> , Lin.)	The wild briar, dog-rose, or hip-tree.	The fruit and flow- ers.	Refrigerant and antiscorbutic.	A distilled water and conserve.

Lift of Simples.	TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	Lift of Simples.
	<i>Cyperus (C. longus, Lin.)</i>	Long cyperus.	The root.	Aromatic and carminative.		
	<i>Dactylus (Phoenix dactylif. Lin.)</i>	The date-tree.	The fruit.	Emollient and slightly astringent.		
	<i>Daucus Creticus (Atbamanta Cretensis, Lin.)</i>	Candy carrot.	The seeds.	Aromatic.	Ingredient in mithridate and theriaca.	
	<i>Daucus fativus (D. carota, Lin.)</i>	The garden carrot.	The roots.	Powerfully antiseptic.	A poultice from them for cancers, and a marmalade.	
	<i>Daucus silvestris (D. carota, Lin.)</i>	Wild carrot.	The seeds.	Aromatic.		
	<i>Dens leonis (Leonodon tarax. Lin.)</i>	Dandelion.	The root and herb.	Attenuant, but doubtful.		
	<i>Diictamnus Creticus (Origanum diictamnus, Lin.)</i>	Dittany of Crete.	The leaves.	Aromatic.	An essential oil; and ingredient in several official powders.	
	<i>Diictamnus albus (Lin.)</i>	Bastard dittany.	The root.	Alexipharmac, tonic, and anthelmintic.		
	<i>Digitalis (D. purpurea, Lin.)</i>	Fox-glove.	The leaves.	Emetic, cathartic, and diuretic.	The leaves in powder or infusion, used in dropsies.	
	<i>Eolichos (D. pruriens, Lin.)</i>	Couhage, or cowitch.	The hairy matter of the pods.	Anthelmintic.		
	<i>Doronicum. See Arnica.</i>					
	<i>Dulcamara (Solanum dulcamara, Lin.)</i>	Bitter-sweet, or woody nightshade.	The herb and root.	Diaphoretic, attenuant, and cathartic.	Watery infusions.	
	<i>Ebulus (Sambucus ebulus, Lin.)</i>	Dwarf-elder, or Danewort.	The root, bark, leaves, and fruit.	Strongly cathartic.	A rob from the berries.	
	<i>Elaterium. See Cucumis.</i>					
	<i>Elatine (Veronica officinalis, Lin.)</i>	Fluellin, or female speedwell.	The leaves.	Diuretic and attenuant.	Gives name to one of the official honeys.	
	<i>Elcampane. See Enula.</i>					
	<i>Elemi (Amyris elemifera, Lin.)</i>	Gum elemi.		Aromatic.	Gives name to an ointment.	
	<i>Eleutheria. See Cascarilla.</i>					
	<i>Endivia (Cichorium endivia, Lin.)</i>	Eudive.	The leaves and roots.	Aperient and refrigerant.		
	<i>Enula (Inula helenicum, Lin.)</i>	Elecampane.	The root.	Expectorant, stomachic, attenuant, and tonic.	Spirituous and watery extracts. A confection.	
	<i>Eruca (Sisymbrium amphibium, Lin.)</i>	Rocket.	The seeds.	Stimulant.		
	<i>Eryngium (E. maritimum, Lin.)</i>	Eryngo, or sea-holly.	The root.	Aperient and diuretic.		
	<i>Erysimum (E. officinale, Lin.)</i>	Hedge-mustard.	The recent plant.	Attenuant and diuretic.		
	<i>Eupatorium cannabinum, (Lin.)</i>	Hemp-agrimony, water-agrimony, or water-hemp.	The leaves.	Attenuant, corroborant, and antiscorbutic.		
	<i>Euphorbium (Euphorbia officinalis, Lin.)</i>	Euphorbium.		Sternutatory.	Powder.	

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Faba Indica, feu Sancti Ignatii, (<i>Ignatia amara</i> , Lin.)	St Ignatius's bean.	The seeds; (the root, the co- lumbo.)	Antispasmodic.	
Faba vicia (<i>Vicia faba</i> , Lin.)	The garden-bean.	The seeds and flow- ers.	Nutritive and cof- metic.	A distilled water from the flowers.
Fagopyrum (<i>Po- lyg. fagopyr.</i> Lin.)	Snakeweed.	The seeds.	Refrigerant.	
Farina tritici vel avenæ.	Bran.		Discutient.	
Ferrium.	Iron.		Corroborative and alterant.	Infusions in wine; the metal reduced to a calx by rust, or by fire, and some salts produced from it by combi- nations with different ac- ids. See CHEMISTRY In- dex.
Ficus. See <i>Carica</i> .				
Filipendula (<i>Spiræa filipend.</i> Lin.)	Common dropwort.	The root.	Astringent and cor- roborant.	
Filix (<i>Polypodium filix mas</i> , Lin.)	The male fern.	The leaves and root.	Anthelmintic and deobstruent.	Powder.
Flammula Jovis (<i>Cle- matis flammula</i> , Lin.)	Upright virgin's- bower.	The leaves and flowers.	Very acrid.	Powder for sprinkling on can- cerous and venereal ulcers; infusion and extract for in- ternal use, in washings, &c. from lues venerea.
Fœniculum dulce et vulgare (<i>Anethum fœnic.</i> Lin.)	Sweet and common fennel.	The seeds, roots, and leaves.	Aromatic, stimu- lant, and carmi- native.	A simple water; and an in- gredient in one or two compositions.
Fœniculum aquati- cum (<i>Phellandri- um aquat.</i> Lin.)	Waterwort.	The leaves and seeds.	Corroborant.	
Fœnum Græcum (<i>Trigonella fœnum- græcum</i> , Lin.)	Fenugreek.	The seeds.	Emollient.	Chiefly used in cataplasms, fomentations, emollient gly- sters, &c.
Fornica (<i>F. rufa</i> , Lin.)	The ant.	The whole insect.	Stimulant.	An oil and acid spirit.
Fragaria (<i>F. vesca</i> , Lin.)	The strawberry bush.	The leaves and fruit.	Astringent, corro- borant, and refri- gerant.	
Frangula (<i>Alnus ni- gra</i> , Lin.)	Black alder.	The bark.	Violently cathartic.	
Fraxinella (<i>Diſtam- nus albus</i> , Lin.)	White or bastard dittany.	The root.	Diaphoretic.	
Fraxinus (<i>F. excel- sor</i> , Lin.)	The ash-tree.	The bark and seeds.	Astringent and sti- mulant.	
Fuligo ligni splen- dens	Shining woodfoot.		Antispasmodic.	A spirituous tincture.
Fumaria (<i>F. officina- lis</i> , Lin.)	Fumitory.	The leaves.	Stimulating, atten- nuant, and an- tiscorbatic.	
Fungus melitensis (<i>Cynomorium coc- cin.</i> Lin.)		The stems and tops.	Tonic and astring- ent.	Decoction and tincture.
Galanga minor (<i>Kempferia Galan- gal</i> , Lin.)	Galangal.	The root.	Stomachic.	
Galbanum (<i>Bubon galbanum</i> , Lin.)	Galbanum.	The gum.	Antihysteric.	An ingredient in several offi- cinal compositions.

List of
Simples.List of
Simples.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Galega (<i>G. officinalis</i> , Lin.)	Goat's rue.	The herb.	Diaphoretic, but very doubtful.	
Callæ (<i>ex Querc. cerr.</i> Lin.)	Galls.		Astringent.	
Callium luteum (<i>G. verum</i> , Lin.)	Yellow ladies bed-straw, or cheese-rennet.	The tops.		
Gambogia. See <i>Gummi gambogia</i> , infra				
Genista (<i>Spartium scoparium</i> , Lin.)	Broom.	The leaves, flowers, and seeds.	Diuretic and cathartic	
Gentiana (<i>G. lutea</i> , Lin.)	Common gentian.	The root.	Stomachic and stimulant	A spirituous tincture, and an ingredient in many official compositions.
Geoffræa (<i>G. inermis</i> , Lin.)	Cabbage-bark, or worm-bark tree.	The bark.	Anthelmintic and purgative.	Powder, decoction, syrup, extract.
Geranium Robertianum (Lin.)	Herb Robert.	The leaves.	Astringent, but very doubtful.	
Ginseng (<i>Panax quinquefol.</i> Lin.)	Ginseng.	The root.	Stimulant and corroborant.	
Gladiolus luteum (<i>Iris pseudacorus</i> , Lin.)	Yellow water-flag, bastard acorus, or water flower-de-luce.	The roots.	Strongly cathartic.	
Glycyrrhiza (<i>G. glabra</i> , Lin.)	Liquorice.	The root.	Emollient and pectoral.	An extract and powder. An ingredient in many official compositions.
Gramen caninum (<i>Triticum repens</i> , Lin.)	Quick-grass.	The roots.	Aperient.	
Grana paradisi (<i>Amomum gr. par.</i> Lin.)	Grains of paradise.	The seeds.	Aromatic and stimulant.	
Granatum (<i>Punica granatum</i> , Lin.)	The pomegranate.	The fruit and flowers.	Refrigerant and astringent.	
Gratiola (<i>G. officinalis</i> , Lin.)	Hedge-hyssop.	The herb.	Emetic and cathartic.	
Guajacum (<i>G. officinale</i> , Lin.)	Lignum-vitæ, or guajacum.	The wood and bark.	Aperient, stimulant, and corroborative.	An extract, two tinctures, and a gummy resin. An ingredient in many official preparations.
Gummi arabicum (<i>Mimosa nilotica</i> , Lin.)	Gum-arabic.		Astringent and mucilaginous.	An ingredient in a great number of official compositions.
Gum ammoniacum (<i>Ferula meoides</i> , Lin. ?)	Gum-ammoniac.		Aperient, antispasmodic, and emollient.	A solution. An ingredient in several pectoral compositions.
Gum. asafetida (<i>Ferula asaf.</i> Lin.)	Asafetida.	The concrete juice.	Antihysterical and anthelminthic.	Tinctures.
Gum. bdellium.	Bdellium.		Sudorific, diuretic, and emollient.	
Gum benzoin (<i>Terminalia benzoin</i> , Lin. <i>Styrax benzoides</i> , Lond. Ph. Transf.)	Benzoin.		Cosmetic.	An ingredient in several anodyne compositions.

Gum.

(M) Dr Cullen informs us, that an ointment composed of one part of powdered galls and eight of hog-lard is a common remedy for the hæmorrhoids, and has been found efficacious.

TECHNICAL NAMES. ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Gum. elemi (<i>Amyris elemifera</i> , Lin.)	Elemi.	Aromatic.	An essential oil, and gives name to ointment.
Gum. galbanum, (<i>Bubon galb</i> Lin.)	Galbanum.	Antispasmodic.	An ingredient in many antihysterical medicines.
Gum. gambogia (<i>Gambogia gutta</i> , Lin. <i>Stalagmites gambogioides</i> , Murray.)	Gamboge.	Emetic and cathartic.	Gives name to a certain kind of pills.
Gum. kino.	Kino.	Astringent.	A tincture.
Gum. labdanum (<i>Cistus ladanifera</i> , Lin.)	Labdanum.	Stomachic.	An ingredient in the stomachic pills and plasters.
Gum. lacca (<i>Coccus lacca</i> , Lin. habitans in <i>Micurellogia</i> , in <i>Mimosa cineraria</i> , & aliis.)	Gum lac.	Astringent.	A tincture.
Gum. mastic, (<i>Pinus lentiscus</i> , Lin.)	Mastic.	Corroborant.	
Gum. myrrha.	Myrrh.	Antispasmodic and corroborant.	A tincture, and an ingredient in many official compositions.
Gummi olibanum, (<i>Juniperus Lycia</i> , Lin.)	Olibanum.	Astringent, but uncertain.	An ingredient in some powders, and other official compositions.
Gummi opoponax (<i>Popinaca opoponax</i> , Lin.)	Opoponax.	Attenuant and stimulant.	An ingredient in some official compositions.
Gum. sanguis draconis. Vid. <i>Sanguis</i> , infra.			
Gum. Senegal (<i>Mimosa Seneg</i> Lin.)		Astringent and mucilaginous.	
Gum. styrax. See <i>Styrax</i> , infra.			
Gum. thus. See <i>Thus</i> , infra.			
Gum. tragacanth (<i>Astragalus trag.</i> Lin.)	Gum tragacanth, commonly gum-dragon.	Astringent and corroborant.	
Hæmatites.	Blood-stone.	Astringent and corroborative.	
Hedera arborea Ivy. (<i>Hedera helix</i> , Lin.)	The leaves, berries, and resin.	Diaphoretic.	
Hedera terrestris, (<i>Glechoma hederacea</i> , Lin.)	Ground-ivy. The leaves.	Aperient and corroborant.	
Helenium See <i>E-nula</i> , supra.			
Helleboraster (<i>Fatidus</i> , Lin.)	Bear's foot. The leaves.	Emetic, purgative, and anthelmintic.	
Helleborus albus, (<i>Veratrum alb.</i> Lin.)	White hellebore. The root.	Most violently emetic and erethic.	A tincture and honey, formerly.
Helleborus niger (<i>Lin.</i>)	Black hellebore, or Melampodium. The root.	A powerful alterative and emmenagogue.	A tincture and extract.

List of
Simples.List of
Simples.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
<i>Hepatica nobilis</i> (Anemone hepatic. Lin.)	Noble liverwort.	The leaves.	Cooling and corroborant.	
<i>Hermodactylus</i> (Iris tuberosa, Lin.)	Hermodactyl.	The root.	Purgative, but doubtful.	
<i>Herniaria</i> (H. glabra, Lin.)	Rupture-wort.	The leaves.	Astringent.	
<i>Hippocastanum</i> (Æscul. hippocast. Lin.)	Horfe-chefnut.	The bark and fruit.	Corroborant and errhine.	
<i>Hordeum</i> (H. distichon, Lin.)	Barley.		Refrigerant.	A decoction.
<i>Horminum</i> (Salvia horminum, Lin.)	Garden-clary.	The leaves and feeds.	Corroborative.	
<i>Hydrargyrum</i> . See <i>Argentum vivum</i> , supra.				
<i>Hydrolapathum</i> (Rumex aquaticus, Lin.)	Great water-dock.	The leaves and roots.	Alterant and laxative.	
<i>Hyofciamus</i> (H. niger, Lin.)	The common wild or black hen-bane.	The leaves and feeds.	Narcotic.	Cataplasm, plaster, powder, ointment.
<i>Hypericum</i> (H. perforatum, Lin.)	St John's wort.	The leaves, flowers, and feeds.	Diuretic, sudorific, and alterant.	Gives name to a coloured oil.
<i>Hypocistis</i> (Cytisus hypocist. Lin.)	Hypocistis.	The juice.	Astringent.	Juice inspissated.
<i>Hyssopus</i> (H. officinalis, Lin.)	Hyssop.	The leaves.	Aromatic and pectoral.	A distilled water.
<i>Jalappa</i> (Convolvulus jalappa, Lin.)	Jalap.	The root.	Cathartic.	An extract, a simple tincture, a compound tincture, a resin, and powder.
<i>Japonica terra</i> . See <i>Catechu</i> , supra.				
<i>Imperatoria</i> (I. officinalis, Lin.)	Mafter-wort.	The root.	Aromatic.	
<i>Indian root</i> . See <i>Radix Indica</i> , infra.				
<i>Ipecacuanha</i> (Ptychotria emetica, Lin.)	Ipecacuanha.	The root (n.)	Emetic and cathartic.	A vinous tincture, and a powder.

Iris

(n) A root has been sometimes imported, under the name of white ipecacuanha (*viola ipecacuanha*, Lin.), which has little or nothing of the virtues of the true kind. More dangerous abuses, however, have been practised by the substitution or mixture of the roots of a kind of *apocynum*, which have been found to operate with great violence both upwards and downwards, so as to prove fatal in some cases. They may, however, easily be distinguished by their colour, which is a deep reddish yellow, while the true ipecacuanha is pale coloured or greyish: the poisonous roots are likewise larger, the fissures more distant, and the intermediate spaces smoother, than in the true ipecacuanha. This root is found to increase the purgative virtue of jalap remarkably. Dr Aikin informs us, that 15 grains of jalap, with two or three of ipecacuanha, purge more than twice the quantity of jalap by itself.

"Of late (says Dr Monro), a notion has prevailed, that the keeping up a nausea by means of small doses of ipecacuanha, or of watery solution of emetic tartar, was of great service in promoting the cure of fevers, as well as of fluxes, from a belief that they affected the nervous system, and were capable of exciting the action of the extreme vessels, and of increasing the secretions by the skin, and of the internal organs. Hitherto I have not found this method to answer my expectations; and I have always observed, that such a dose of an emetic as emptied the stomach freely, and gave a shake to the whole frame, had a much better effect than

thoſe

List of Simples.	TECHNICAL NAMES. ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	List of Simples.
	Iris Florentina, Florentine oris. (<i>Lin.</i>)	The root.	Aromatic and sti- mulant.	An ingredient in several pec- toral medicines.	
	Iris palustris. See <i>Gladiolum</i> , supra.				
	Juglans (<i>J. regia</i> , The walnut-tree. <i>Lin.</i>)	The fruit.	The kernel emol- lient, the shell astringent.		
	Jujuba, (<i>Rhamnus</i> Jujubes. <i>zizyph.</i> <i>Lin.</i>)	The fruit.	Emollient and bal- samie.		
	Juncus odoratus. See <i>Calamus</i> , fu- pra.				
	Juniperus (<i>J. com- munis</i> , <i>Lin.</i>)	The berries, wood, and resin.	Carminative and stomachic.	Aneffential oil, and spirituous water. Ingre dient in fev- eral official compositions.	
	Kermes (<i>Coccus querc. ilic.</i> <i>Lin.</i>)	Kermes.	Astringent and cor- roborant.	A confection.	
	Kino. See Gum <i>Kino</i> , supra.				
	Lac.	Milk.	Analeptic and cor- roborant.	A saccharine salt.	
	Lacca. See Gum <i>Lacca</i> , supra.				
	Lactuca, (<i>L. sati- va</i> , <i>Lin.</i>)	Garden lettuce. The leaves and seeds.	Supposed narcotic.		
	Lactuca virofa, Wild lettuce. (<i>Lin.</i>)	Juice.	Laxative, diuretic, and diaphoretic.	An extract.	
	Ladanum (<i>Cistus creticus</i> , <i>Lin.</i>)	Ladanum. The gum-resin.		Ingredient in the stomachic plaster.	
	Lamium album White archangel, (<i>Flor.</i>) or dead-nettle.	The leaves and flowers.	Supposed corbo- rant.		
	Lavendula (<i>L. Spi- ca</i> , <i>Lin.</i>)	Greater, or broad- leaved lavender. The flowers.	An excellent cor- dial and aroma- tic.	An effential oil, a simple and compound spirit, and a conserve. An ingredient in some official preparations.	
	Laurus (<i>L. nobilis</i> , The bay-tree. <i>Lin.</i>)	The leaves and ber- ries.	Carminative and antispasmodic.	An expressed oil. An ingre- dient in different composi- tions.	
	Lentiscus (<i>Pistacia lentiscus</i> , <i>Lin.</i>)	The lentisc or ma- stich tree. The wood.	Astringent, tonic, and diuretic.		
	Lepidium, (<i>L. lati- fol.</i> <i>Lin.</i>)	Common broad dit- tander, pepper- wort, or poor man's pepper. The leaves.	Antiscorbatic and diuretic.		
	Levisticum (<i>Ligu- sticum levisticum</i> , <i>Lin.</i>)	Lovage. The root and seed.	Aromatic.	Ingredients in some compound waters.	
	Lichen cinereus ter- restris (<i>L. cani- nus</i> , <i>Lin.</i>)	Ash-coloured ground liver- wort. The whole.	Recommended by Dr Mead as a spe- cific against the bite of a mad dog, but without foun- dation.	Principal ingredient in the <i>pulvis antilyssus</i> .	
	Lichen islandicus Eatable liverwort. (<i>Lin.</i>)	The herb.	Nourishing, antisep- tic, and laxative.		

those frequently repeated small doses, which kept the patient in a disagreeable uneasy situation for hours to-
gether; and I am persuaded, that no practitioner of experience, who has attended large hospitals, where he
has had an opportunity of trying and seeing the effects of different medicines, will ever recommend this nau-
seating method for general practice in fevers, though it may be of use in some particular cases."

List of Simples.	TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	List of Simples.
	Lignum campe- chense (<i>Ha- matoxylum com- pach.</i> Lin.)	Logwood.	The wood.	Astringent.	An extract.	
	Lignum rhodium, (<i>Genista canari- ensis</i> , Lin.)	Rose-wood.	The wood.	Cordial.	An essential oil.	
	Ligusticum. See <i>Levisticum</i> , supra.					
	Lilium convallium, (<i>Convall. maial.</i> Lin.)	Lilly of the valley.	The root and flow- ers.	Cephalic and ner- vine.		
	Lilium album, (<i>L.</i> White lily. <i>candidum</i> , Lin.)		The root.	Emollient.	Poultice.	
	Limon, (<i>Citrus me- dica</i> , Lin.)	The lemon-tree.	The fruit.	Aromatic, antiscor- butic, and cordial.	An essential oil; an ingredi- ent in several compositions.	
	Linaria (<i>Antirrhini- num linaria</i> , Lin.)	Toad-flax.	The leaves.	Diuretic and ca- thartic, but doubtful.		
	Lingua cervina, (<i>Asplenium scolopend.</i> Lin.)	Hart's tongue.	The leaves.	Aperient.		
	Linum catharticum (<i>Euphorbia lathy- rus</i> , Lin.)	Purging flax.	The leaves.	Cathartic.	Infusion in whey. Dried powder.	
	Linum Sativum Flax. (<i>L. usitatissimum</i> , Lin.)		The seed.	Emollient.	An expressed oil. Cataplasma.	
	Liquida ambra (<i>a- cernegundo</i> , Lin.)	Sweet gum, or stor- rax tree.	The resinous juice.	Aromatic and cor- dial.		
	Lithospermum (<i>L.</i> Gromwell. <i>officinale</i> , Lin.)		The seeds.	Resolvent; lithon- triptic.		
	Lobelia (<i>L. sp. hilti- ca</i> , Lin.)	Blue cardinal flower.	The root (o).	Alterant, and deter- gent.	Decoction.	
	Lujula, or wood- sorrel. See <i>Ace- tosella</i> , supra.					
	Lumbrici et limaces terrestres.	Earth worms and snails.		Aperient and ana- leptic.	Decoction in milk.	
	Lupinus (<i>L. albus</i> , Lin.)	White lupines.	The seeds.	Anthelmintic.		
	Lupulus (<i>Humul.</i> <i>lup.</i> Lin.)	Hops.	The loose leafy heads which grow upon the tops of the stalks.	Diuretic and stoma- chic.		

Lycoperdon

(o) This root was long a famous secret among the North American Indians for curing the venereal disease. The secret was purchased by Sir William Johnson, and has been published in the writings of Bartram, Kalm, &c. The following method of using it is, by Dr Aikin, recommended as the best: "A decoction is made of an handful of the roots in three measures of water. Of this half a measure is taken in the morning fasting, and repeated in the evening; and the dose is gradually increased till its purgative effect becomes too violent, when the medicine is for a time to be intermitted, and then renewed till a perfect cure is effected. One dose daily is sufficient during the latter part of the treatment; and the regimen, during the whole process, is to be equally strict with that observed in a course of mercurial salivation. From the third day, the ulcers are to be well washed twice daily with the decoction; and it is said, that when they are very deep and foul, the Indians sprinkle them with powder of the internal bark of the spruce tree. By this method we are assured that inveterate venereal complaints are cured without the aid of mercury."

List of Simples.	TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	List of Simples.
	<i>Lycoperdon</i> (<i>L. bovista</i> , Lin.)	Puff-ball, or dusty mushroom.	The whole.	Styptic.		
	<i>Macis</i> . See <i>Nux Moschata</i> , infra.					
	<i>Majorana</i> (<i>Origanum majorana</i> , Lin.)	Sweet marjoram.	The leaves and flowers.	Aromatic and er- rhine.	An essential oil.	
	<i>Malabathrum</i> (<i>Laurus cassia</i> , Lin.)	Indian leaf.		Aromatic.	An ingredient in mithridate and theriaca.	
	<i>Malva</i> (<i>M. sylvestris</i> , Lin.)	The mallow.	The leaves and flowers.	Emollient.	Ingredient in the decoction for glysters, used also in cataplasms and fomentations: formerly there was a conserve of the flowers.	
	<i>Malus</i> (<i>Pyrus malus</i> , Lin.)	The apple-tree.	The fruit.	Refrigerant and laxative.		
	<i>Mandragora</i> (<i>Atropa Mandrag.</i> Lin.)	The mandrake.	The leaves.	Narcotic.		
	<i>Manna</i> (<i>Fraxinus ornus</i> , Lin.)	The manna ash.	The concreted juice.	Laxative.	Gives name to an official lo- hoch, and enters several o- ther compositions.	
	<i>Marrubium</i> (<i>M. vulgare</i> , Lin.)	White horehound.	The leaves.	Stomachic and ape- rient.	An ingredient in theriaca (p).	
	<i>Marum Syriacum</i> (<i>Teucrium mar.</i> Lin.)	Syrian herb ma- stich.	The leaves.	Aromatic and er- rhine.	An ingredient in some cepha- lic snuffs.	
	<i>Mastiche</i> . See <i>Gum mastic</i> , supra.					
	<i>Matricaria</i> (<i>M. parthenium</i> , Lin.)	Feverfew.	The leaves and flowers.	Aperient and an- tipalmodic.		
	<i>Mechoacanna</i> , (<i>Convolvulus mechoac.</i> Lin.)	White jalap, or Mc- choacan.	The root.	Cathartic.		
	<i>Mel</i> .	Honey.		Aperient and de- tergent.		
	<i>Melampodium</i> . See <i>Helleborus niger</i> , supra.					
	<i>Mellilotus</i> (<i>Trifolium melilot.</i> Lin.)	Mellilot.	The leaves and flowers.	Emollient and car- minative.	Gives name to a plaster.	
	<i>Melissa</i> (<i>M. officin.</i> Lin.)	Balm.	The leaves.	Aromatic.	An essential oil, and an in- fusion.	
	<i>Melo</i> (<i>Cucumis melo</i> , Lin.)	The melon.	The seeds.	Refrigerant and emollient.		
	<i>Mentha crispata</i> (Lin.)	Danish or German curled mint.	The herb.	Aromatic and cor- dial,	A distilled water, essential oil, and essence. An ingredient in several official prepara- tions.	
	<i>Mentha vulgaris</i> , (<i>M. viridis</i> , Lin.)	Spearmint.	The herb.	Aromatic and cor- dial.	A distilled water, an essential oil, a spirit, and essence. An ingredient in several official preparations.	

Mentha

(p) The juices of horehound and plantain mixed are remedies of great repute in America against the bite of the rattlesnake. They are given by spoonfuls at short intervals; while at the same time the wounded part is covered with a cataplasm of the same herbs bruised. The good effects are said to be speedy, and the recovery of the patient complete and certain.

List of
Simples.List of
Simples.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
<i>Mentha piperitis</i> (M. <i>piperita</i> , Lin.)	Pepper-mint.	The herb.	Aromatic and cordial.	A distilled water, essential oil, and essence. An ingredient in several official preparations.
<i>Mercurialis</i> (M. <i>annua</i> , Lin.)	French mercury.	The leaves.	Emollient and laxative.	A syrup.
<i>Meum</i> (<i>Aethusa meum</i> , Lin.)	Spiguel.	The root.	Aromatic and carminative.	
<i>Mezereon</i> (<i>Daphne mezereum</i> , Lin.)	Mezereon, or spurge olive.	The bark of the root.	Violently cathartic.	Decoction and powder.
<i>Millefolium</i> (<i>Achillea millefol.</i> Lin.)	Millefoil, or yarrow.	The leaves and flowers.	Mildly astringent and aromatic.	An essential oil.
<i>Millepedæ</i> (<i>Oniscus asellus</i> , Lin.)	Wood-lice, hog-lice, or flaters.		Diuretic.	The insects dried and powdered; an infusion in wine; also an ingredient in some other official preparations.
Minium. See <i>Plumbum</i> , <i>infra</i> .				
<i>Morus diabolus</i> (<i>Scabiosa succisa</i> , Lin.)	Devil's bit.	The leaves and roots.	Diaphoretic.	
<i>Morus nigra</i> (Lin.)	The mulberry-tree.	The fruit and bark of the roots.	Refrigerant, astringent, and antihelminthic.	A syrup from the juice of the fruit.
<i>Moschus</i> (M. <i>moschiferus</i> , Lin.)	Musk.		Diaphoretic and antispasmodic.	A julep.
Myristica. See <i>Nux moschata</i> , <i>infra</i> .				
<i>Myrobalani</i> (<i>Prunus myrobalanus</i> , Lin.)	Myrobalans.	The fruit.	Purgative.	
Myrrha. See <i>Gum myrrha</i> , <i>supra</i> .				
<i>Myrrhia</i> (<i>Sison Canadense</i> , Lin.)	Sweet cicely.	The leaves and seeds.	Diuretic.	
<i>Myrtillus</i> (<i>Vaccinium myrtill.</i> Lin.)	Whortle-berry.	The leaves and berries.	Astringent.	
<i>Myrtus</i> (M. <i>communis</i> , Lin.)	The myrtle.	The berries.	Astringent.	
<i>Napus</i> (<i>Brassica napus</i> , Lin.)	Sweet navew, or navew gentile.	The seeds.	Aromatic.	An ingredient in the theriaca.
<i>Nardus Indica</i> , (<i>Andropogon nardus</i> , Lin.)	Indian nard.	The roots.	Stomachic and carminative.	Ingredient in the mithridate and theriaca.
<i>Nasturtium aquaticum</i> (<i>Sisymbrium nasturtium</i> , Lin.)	Water cresses.	The leaves and juice.	Aperient and antiscorbutic.	An ingredient in the succi scorbutici.
<i>Nasturtium hortense</i> (<i>Lepidium sativum</i> , Lin.)	Garden cresses.	The leaves and seeds.	Aperient and antiscorbutic, but much weaker than the former.	
<i>Nepeta</i> (N. <i>cataria</i> , Lin.)	Nep, or catmint.	The leaves.	Aromatic and cordial.	
<i>Nephriticum lig-num</i> (<i>Gulandina moringa</i> , Lin.)	Nephritic wood.	The wood in substance.	Diuretic, but uncertain.	
<i>Nicotiana</i> (<i>Nicotiana tabacum</i> , Lin.)	Tobacco.	The leaves.	Violently emetic, cathartic, and narcotic.	An extract recommended by Stahl and other German physicians.

Nigella

List of Simples.	TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	List of Simples.
	<i>Nigella</i> (<i>Nigella</i> <i>fativa</i> , Lin.)	Fennel-flower.	The seeds.	Aperient and diuretic, but uncertain.		
	Nitrum.	Nitre or salt-petre.		Diaphoretic, diuretic, and refrigerant.	An acid spirit and fixed alkaline salt, an aqueous decoction or solution, troches. An ingredient in many other official preparations.	
	Nummularia (<i>Ly-</i> <i>simachia nummu-</i> <i>laria</i> , Lin.)	Moneywort, or herb twopence.	The leaves.	Antiscorbutic.		
	Nux moschata (<i>Myrsifica</i> <i>arom-</i> <i>atica</i> , Lin. <i>My-</i> <i>rsifica moschata</i> , A&S. Holm.)	The nutmeg-tree.	The fruit, and co- vering called <i>mace</i> .	An excellent aromatic, cordial, and stomachic.	An expressed oil, falsely called <i>oil of mace</i> ; an essential oil; a simple water; a spirituous water; an ingredient in many official compositions.	
	Nux pistachia (<i>Pi-</i> <i>stachia vera</i> , Lin.)	The pistachia-tree.	The fruit.	Emollient and analeptic.		
	Nux vomica (<i>Styracnas nux</i> <i>vom.</i> Lin.)	Nux vomica.	The fruit.	Narcotic.		
	Nymphaea alba (Lin.)	White water-lily.	The roots and flowers.	Astringent and corroborative.		
	Ochra	Yellow ochre.		Astringent, but very weak.		
	Oenanthe (<i>Oe. cro-</i> <i>cata</i> , Lin.)	Hemlock drop- wort.	Leaves and root.	A virulent poison:	But the juice of the root, or the infusion of the leaf, has been recommended in chronic eruptions. The latter has been also found useful as an emmenagogue.	
	Olibanum. See <i>Gum</i> <i>olibanum</i> , supra.					
	Oliva (<i>Olea Euro-</i> <i>pea</i> , Lin.)	The olive-tree.	The fruit.	Emollient.	An expressed oil used in almost all ointments, plasters, &c.	
	Ononis (<i>O. spinosa</i> , Lin.)	Rest-harrow, cam- mock, or petty- whin.	The root.	Aperient and diuretic.		
	Opium (<i>Papaver</i> <i>Orientalis</i> , Lin.)	The Asiatic poppy.	The inspissated juice.	A most excellent anodyne and cordial when properly applied, but a very fatal poison if taken in too great quantity.	Purified by straining, called the <i>Thebaic extract</i> ; a sinous and spirituous tincture, called <i>liquid laudanum</i> . Also a capital ingredient in many official preparations.]	
	Opopanax. See <i>Gum</i> <i>opopanax</i> , supra.					
	Origanum (<i>O. vulg.</i> Lin.)	Wild marjoram.	The leaves.	Aromatic.	An essential oil.	
	Oryza (<i>O. sativa</i> , Lin.)	Rice.	The grain.	Emollient and refrigerant.		
	Oxylapathum (<i>Rumex acutus</i> , Lin.)	Sharp-pointed dock.	The roots and leaves.	Alterant and laxative.		
	Paeonia (<i>P. officina-</i> <i>lis</i> , Lin.)	Male and female peony.	The roots, flowers, and seeds.	Emollient and antispasmodic.	Ingredients in some anti-epileptic powders.	
	Palma (<i>Cocos buty-</i> <i>racea</i> , Lin.)	The palm-tree.	The kernels of the fruit.	Emollient and anodyne.	An expressed oil used in stomachic plasters.	
	Palma Christi. See <i>Ricinus</i> , infra.					

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Papaver album (<i>P. somniferum</i> , Lin.)	The white poppy.	The heads.	Anodyne.	A syrup.
Papaver erraticum (<i>P. rhæas</i> , Lin.)	Red poppy, or corn-rose.	The flowers.	Valued chiefly for the colour they communicate.	A syrup.
Paralyfis (<i>Primula veris offic.</i> Lin.)	Cowslip.	The flowers.	Corroborant and antispasmodic.	A syrup.
Parcira brava (<i>Cis- sampelos parcira</i> , Lin.)	Parcira brava.	The root.	Attenuant, diuretic, and lithon- triptic.	
Parietaria (<i>P. of- ficinalis</i> , Lin.)	Pellitory of the wall.	The leaves.	Emollient and di- uretic.	Ingredient in a nephritic de- coction.
Pastinaca (<i>P. sati- va</i> , Lin.)	Garden parsnip.	The roots and seeds.	Emollient and aro- matic.	
Pastinaca silvestris (Lin.)	Wild parsnip.	The seeds.	Aromatic.	
Pentaphyllum (<i>Potentilla rep- tans</i> , Lin.)	Cinquefoil.	The root.	Astringent.	
Perficaria urens (<i>Polygonum hy- dropiper</i> , Lin.)	Bitter arsmart, lake-weed, or water-pepper.	The leaves.	Diuretic and deter- gent when exter- nally applied.	
Perficaria mitis (<i>Polygonum per- fic.</i> Lin.)	Spotted arsmart.	The leaves.	Antiseptic and a- stringent.	
Perfica (<i>Amygdalus perfica</i> , Lin.)	The peach-tree.	The leaves, flowers, and fruit.	Laxative, anthel- mintic, and re- frigerant.	
Peruvianus cortex (<i>Cinchona offic- nalis</i> , Lin.)	The quinquina, or Jesuit's-bark- tree.	The bark.	A most excellent corroborative.	An extract, a resin, a spirituous tincture, a compound tin- cture, a tincture in volatile spirit; also an ingredient in the stomachic tincture.
Petasites (<i>Tussilago petasites</i> , Lin.)	Butterbur.	The root.	Aromatic, aper- ient, and deob- scurant.	
Petroleum.	Rock oil.		Anodyne and cor- roborative when applied external- ly.	
Petroleum Barba- denſe (<i>Bitumen petroleum</i> , Lin.)	Barbadoes tar.		Discutient, sudori- fic, and corrobo- rative.	
Petroelinum (<i>A- gium petroelinum</i> , Lin.)	Common parsley.	The roots, leaves, and seeds.	Aperient and some- what aromatic.	The seeds an ingredient in an electuary.
Peucedanum (<i>P. of- ficinale</i> , Lin.)	Hog's-fennel, or sulphur-wort.	The root.	Aperient, stimu- lating, and er- rhine.	
Pimenta (<i>Myrtus pimenta</i> , Lin.)	Pimento, Jamaica pepper, or all- spice.	The berry.	Aromatic and sti- mulant.	The basis of a distilled wa- ter, a spirit, and an essen- tial oil.
Pimpinella sangui- forba (<i>Sanguifor- ba officinalis</i> , Lin.)	The greater wild burnet.	The leaves.	Astringent.	
Pimpinella faxifra- ga (Lin.)	Burnet faxifrage.	The root, leaves, and seeds.	Diaphoretic, diu- retic, and anti- scorbutic.	
Pinus sylvestris (Lin.)	The pine-tree.	The kernels of its fruit or cones, and resin.	The kernels emol- lient; for the re- sin, see <i>Terebin- thina</i> , infra.	

TECHNICAL NAMES. ENGLISH NAMES.

PARTS USED IN
MEDICINE.

VIRTUES.

PREPARATIONS FROM THEM.

Piper longum (<i>Lin.</i>)	Long pepper. }			Highly aromatic	
Piper nigrum (<i>Lin.</i>)	Black pepper. }			and stimulant.	
Piper Jamaicense.					
See <i>Pimenta</i> , fu-					
pra.					
Piper Indicum	Guinea pepper.				A powder called <i>Cayenne pep-</i>
(<i>Capicum an-</i>					<i>per.</i>
nium, <i>Lin.</i>)					
Pix liquida (<i>Pi-</i>	Tar.			Attenuant and Ri-	An infusion in water, and an
nus <i>syloestris</i> ,				mulating.	ingredient in a kind of pec-
<i>Lin.</i>)					toral pills.
Pix Burgundica	Burgundy pitch.			A warm adhesive	Ingredient in several plasters,
(<i>Pinus abies</i> ,				resinous sub-	ointments, and cerates.
<i>Lin.</i>)				stance.	
Plantago latifolia,	Common broad-	The leaves.		Astringent.	
<i>P. major</i> , (<i>Lin.</i>)	leaved plantane.				
Plumbum.	Lead.			Astringent and re-	Several chemical preparations.
				frigerating, but	See <i>CHEMISTRY-Index</i> . A
				very dangerous.	tincture and extract, or so-
					lution in vegetable acids;
					also an ingredient in several
					ointments, &c.
					Ingredient in the Mithridate
					and theriaca.
Polium montanum	Poley-mountain.	The tops.		Aromatic.	
(<i>Teucrium poli-</i>					
um, <i>Lin.</i>)					
Polygala amara	Milkwort.	The root.		Purgative.	
(<i>Lin.</i>)					
Polygala fenega	Rattlefnake root.	The roots.		Stimulating, atten-	
(<i>Lin.</i>)				nuant, and diu-	
				retic.	
Polypodium (<i>P.</i>	Polypody.	The root.		Laxative.	
<i>vulgare</i> , <i>Lin.</i>)					
Populus nigra,	Black poplar.	The buds.		Aromatic.	Used only in an ointment, but
(<i>Lin.</i>)					capable of being applied to
					better purposes.
Porrum (<i>Allium</i>	The leek.	The root.		A stimulating diu-	
<i>porrum</i> , <i>Lin.</i>)				retic.	
Portulaca (<i>P. ole-</i>	Purslane.	The seeds.		Refrigerant.	
<i>racea</i> , <i>Lin.</i>)					
Primula veris (<i>Lin.</i>)	Primrose.	The herb and root.		Aromatic and flo-	An infusion and distilled spi-
				machic.	rit.
Prunella (<i>P. vulga-</i>	Self-heal.	The leaves.		Attenuant and de-	
<i>ris</i> , <i>Lin.</i>)				tergent.	
Pruna Gallica (<i>Pru-</i>	French or common	The fruit.		Cooling and ape-	
<i>nus domestica</i> , <i>Lin.</i>)	prunes.			rient.	
Prunus Sylvestris.					
See <i>Acacia Ger-</i>					
<i>manica</i> , supra.					
Psyllium (<i>Planta-</i>	Flcawort.	The seeds.		Emollient and laxa-	
<i>go psyll</i> , <i>Lin.</i>)				tive.	
Ptarmica (<i>Achillea</i>	Sneezewort, or ba-	The root.		Errhine and stimu-	
<i>ptarmica</i> , <i>Lin.</i>)	lard pellitory.			lating.	
Pulegium (<i>Meniba</i>	Pennyroyal.	The flower.		A warm aromatic.	A simple water, a spirituous
<i>puleg</i> , <i>Lin.</i>)					water, an essential oil; and
					an ingredient in some other
					official compositions.
Pulmonaria maculo-	Spotted lung-wort,	The leaves.		Said to be aperient	
sa (<i>P. officinalis</i> ,	or sage of Jeru-			and analeptic.	
<i>Lin.</i>)	salem.				
Pulsatilla nigricans	Meadow anemone.	The herb and		Emetic, diuretic,	An extract and distilled water,
(<i>Anemone pra-</i>		flower.		and cathartic.	used in venereal complaints,
<i>tenf</i> , <i>Lin.</i>)					and certain disorders of the
					eye.

TECHNICAL NAMES. ENGLISH NAMES.		PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Pyrethrum (<i>Anthemis pyrethra</i> , Lin.)	Pellitory of Spain.	The root.	Promotes the salival flux.	
Quassia (<i>Q. Simarouba</i> , Lin.)	Simarouba.	The bark.	Antifeptic; useful in dysentery.	See <i>Ed. Phil. Trans.</i> vol. ii.
Quassia (<i>Q. amara</i> , Lin.)	Quassy.	The wood.	Stomachic and tonic.	An extract.
Quercus (<i>Q. robur</i> , Lin.)	Oak-tree.	The bark.	Strongly astringent.	
Quercus marina (<i>Fucus vesiculosus</i> , Lin.)	Sea-wrack or Sea-oak.	The herb.	Astringent and detergent.	A powder of the burnt herb.
Radix Indica Lopeziana (<i>Gamb. Advers.</i>)	Indian or Lopez root.		Astringent.	
Raphanus ruscitarnus (<i>Cochlearia armoracea</i> , Lin.)	Horfe-radish.	The root.	Stimulating and attenuant.	A compound water.
Rhabarbarum (<i>Rheum palmat.</i> Lin.)	Rhubarb.	The root.	Cathartic and stomachic.	Toasted; a watery infusion; vinous and spirituous tinctures; and an ingredient in several official compositions.
Rhamnus catharticus. See <i>Spina cervina</i> , infra.)				
Rhaponticum (<i>Rheum rhopon.</i> Lin.)	Rhapontic.	The roots.	Laxative.	
Rhododendron chrysanthemum (Lin.)	Rhododendron.	The herb.	Powerfully sedative.	Decoction and powder; lately found serviceable in the gout and rheumatism.
Ribes nigrum (Lin.)	The black-currant bush.	The fruit.	Refrigerant and detergent.	} A jelly.
Ribes rubrum (Lin.)	The red-currant bush.	The fruit.	Ditto.	
Ricinus, (<i>R. communis</i> , Lin.)	Palma Christi.	The seed.	Laxative, anthelmintic.	Expressed oil.
Rosa damascena (<i>R. centifolia</i> , Lin.)	Damask rose.	The flower.	Aromatic and gently laxative.	A distilled water and syrup.
Rosa rubra (<i>R. Gallica</i> , Lin.)	The red rose.	The flower.	Astringent and corroborative.	A conserve, honey, tincture, troches, vinegar, and syrup. An ingredient in several official compositions.
Rosmarinus hortensis (<i>R. officinalis</i> , Lin.)	Rosemary.	The tops and flowers.	A fine aromatic and cordial.	An essential oil; a distilled spirit called <i>Hungary water</i> . An ingredient in many cordial and antispasmodic medicines.
Rubia tinctorum, (Lin.)	Madder.	The root.	Aperient and detergent.	
Rubus idæus, (Lin.)	The rasp-berry bush.	The fruit.	Refrigerant.	A syrup.
Rubus niger (<i>R. fruticosus</i> , Lin.)	The bramble.	The leaves.	Astringent.	
Rufcus (<i>R. aculeatus</i> , Lin.)	Butcher's-broom, or knee-holly.	The root.	Aperient.	Ingredient in diet-drinks.
Ruta (<i>R. graveolens</i> , Lin.)	Broad-leaved rue.	The leaves and seeds.	Powerfully stimulating, attenuating, and detergent.	An extract; and an ingredient in several compositions.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Sabadilla. See <i>Cevadilla</i> , supra.				
Sabina (<i>Juniperus sabina</i> , Lin.)	Savin.	The leaves or tops.	A stimulating aperient.	An essential oil; a watery extract; and an ingredient in several official compositions.
Saccharum (<i>Arundo saccharifera</i> , Lin.)	Sugar, refined and brown.			
Saccharum cantum, album & rubrum.	Sugar-candy, white and brown.		Emollient and laxative.	
Sagapenum (<i>Ferula orientalis</i> , Lin.)	Gum sagapenum.		Aperient and deobstruent.	An ingredient in several antispasmodic medicines.
Sal alkali vegetabile.	Vegetable alkaline salt, or pearl-salt.		Aperient, diuretic, and caustic.	The basis of a great number of neutral salts.
Sal alkali minerale.	Mineral alkali, salt of Soda, or basis of sea-salt.		Ditto.	Ditto.
Sal ammoniac. See <i>Ammoniac</i> .				
Sal catharticus amarus.	Epsom salt.		Cathartic.	Magnesia.
Sal commune.	Common salt.		In small doses stimulant, in large ones cathartic.	
Salicaria (<i>Lythrum Salicaria</i> , Lin.)	Purple loose-strife.	The herb.	Astringent.	
Salix (<i>S. fragilis</i> , Lin.)	The crack-willow.	The bark.	Corroborant.	
Salvia (<i>S. officinalis</i> , Lin.)	Common sage.	The leaves.	Moderately stimulating and astringent.	Infusions.
Sambucus (<i>S. nigra</i> , Lin.)	Common black-berryed alder.	The leaves, bark, flowers and berries.	Cathartic, aromatic, and aperient.	A rob for internal use from the berries, and an ointment and oil from the flowers and bark; the flowers are also ingredients in some compound waters.
Sanguis draconis, (<i>Calamus rotang</i> , <i>Dracena druto</i> , <i>Pterocarpus, draco</i> , &c. Lin.)	Dragon's-blood.		Astringent.	An ingredient in some official compositions.
Sanicula (<i>S. Europaea</i> , Lin.)	Sanicle.	The leaves.	Supposed to be corroborant.	
Santalum citrinum, (<i>S. album</i> , Lin.)	Yellow sanders.	The wood.	Greatly recommended by Hoffman as a restorative.	Essential oil; extract.
Santalum rubrum, (<i>Pterocarpus santalinus</i> , Lin.)	Red sanders.	The wood.	Used only for its colour.	
Santonium (<i>Artemisia santonica</i> , Lin.)	Worm-seed.		Anthelmintic.	

TECHNICAL NAMES. ENGLISH NAMES.		PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Sapo durus.	Hard Spanish soap.	}	Resolvent and stimulating.	{ The first gives name to a plaster, liniment, balsam, and pills; the second is an ingredient in the milder caustic; and the third in an anodyne plaster.
Sapo mollis.	Common soft soap.			
Sapo niger.	Black soap.			
Saponaria (<i>S. officinalis</i> , Lin.)	Soapwort or bruise-wort.	The herb and root.	Aperient, corroborant, and sudorific.	Tincture; extract.
Sarcocolla (<i>Penaea farcoc.</i> Lin.)	Gum sarcocoll.		Supposed a vulnerary.	Ingredient in the pulvis æcerussa.
Sarsaparilla (<i>Smilax farfap.</i> Lin.)	Sarsaparilla.	The root.	Alterant, and diaphoretic.	Infusions and extract.
Sassafras (<i>Laurus sassafras</i> , Lin.)	Sassafras.	The root.	Alterant, aperient, and corroborant.	An essential oil; an ingredient in some officinal preparations.
Satureia (<i>S. hortensis</i> , Lin.)	Summer savory.	The leaves.	A very pungent warm aromatic.	
Satyrium mas (<i>Orchis mascula</i> , Lin.)	Orchis.	The root.	Coagulant and corroborative.	Supposed to be a preparation from a root of this kind.
Saxifraga alba (<i>S. granulata</i> , Lin.)	White-flowered saxifrage.	The roots and leaves.	{ Supposed to be aperient, diuretic, and lithontriptic, but without just foundation.	
Saxifraga vulgaris (<i>Peucedanum fistula</i> , Lin.)	Meadow saxifrage.	The leaves and seeds.		
Scabiosa (<i>S. arvensis</i> , Lin.)	Scabious.	The leaves.	Aperient, sudorific, and expectorant.	
Scammonium (<i>Convolvulus scam.</i> Lin.)	Scammony.	Roots.	Strongly cathartic.	Gives name to a powder, and is an ingredient in some officinal preparations.
Scilla (<i>S. maritima</i> , Lin.)	The squill, or sea-onion.	The root.	Powerfully diuretic, stimulant, and expectorant.	A syrup, vinegar, oxymel, pills; the root dried, baked, and made into troches.
Scolopendrium.	See <i>Lingua cervina</i> , supra.			
Scordium (<i>Teucrium scordium</i> , Lin.)	Water germander.	The leaves.	Deobstruent, diuretic, and sudorific, but doubtful.	An ingredient in mithridate, theriaca, and several other preparations.
Scorzonera (<i>S. bifpanica</i> , Lin.)	Viper's grass.	The root.	Cordial and stimulant, but doubtful.	
Scrophularia (<i>S. nodosa</i> , Lin.)	Fig-wort.	The leaves and root.	Supposed corroborant, but doubtful.	
Sebesten (<i>Cordia myxa</i> , Lin.)	Sebesten plum.		Emollient.	
Sedum acre (Lin.)	Wall stone crop, or wall pepper.	The fresh plant.	Strongly purgative, emetic, and diuretic.	
Sedum majus (<i>S. album</i> , Lin.)	Greater houseleek.	The leaves.	Refrigerant.	
Seneca. See <i>Polygala seneca</i> , supra.				
Senna (<i>Cassia senna</i> , Lin.)	Senna.	The leaves.	Cathartic.	Infusion, spirituous tinctures, compound powders, and an electuary.

TECHNICAL NAMES. ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Serpentaria Virg- niana (<i>Aristolochia serpentaria</i> , Lin.)	Virginian snake- weed.	The root.	A warm diaphoretic and diuretic.
Serpyllum (<i>Thymus serpyll.</i> Lin.)	Mother of thyme.	The herb.	Aromatic.
Seclis vulgaris, (<i>Tordylium officin.</i> Lin.)	Common hartwort.	The seeds.	} Agreeable aromatics, but neglected. <i>Lewin.</i>
Seclis masiliensis (<i>Seclis elatum</i> , Lin.)	Hartwort of Mar- seilles.	The seeds.	
Sigillum Salomo- nis (<i>Convallaria polygon.</i> Lin.)	Solomon's seal.	The root.	Probably emollient.
Simarouba. See <i>Quassia simarouba</i> , supra.			
Sinapi (<i>Sinapis alba & nigra</i> , Lin.)	Mustard.	The seeds, black and white.	Strongly pungent and stimulant.
Sium (<i>S. nadiiflorum</i> , Lin.)	Creeping skerrit, or water parsnip.	The herb.	The juice serviceable in some cutaneous disorders.
Solanum (<i>S. nigr.</i> Lin.)	Nightshade.	The leaves.	Powerfully evacuant.
Spermaceti (<i>Physter macrocephalus</i> , Lin.)	Spermaceti.		A mild emollient. Gives name to a lochoch.
Spigelia (<i>S. Marilandica</i> , Lin.)	Indian pink.	The root.	Anthelmintic.
Spina cervina, (<i>Rhamnus catharticus</i> , Lin.)	Buckthorn.	The berries.	Strongly cathartic. A syrup.
Spiritus vinosi.	Vinous spirits.		Cordial and stimulant.
Spengia (<i>S. officinal.</i> Lin.)	Sponge.		Used as a tent for dilating ulcers, &c.
Stannum.	Tin.		Anthelmintic.
Staphisagria (<i>Delphinium staphisagria</i> , Lin.)	Stavesacre.	The seeds.	A violent cathartic taken internally, Its external application destroys lice and other insects.
Stoechas (<i>Lavendula stoechas</i> , Lin.)	Arabian stoechas, or French lavender.	The flowers.	Aromatic.
Stramonium (<i>Datura stramon.</i> Lin.)	Thorn-apple.	The herb.	Narcotic.
Styrax calamita (<i>S. Styracis</i> , Lin.)	Liquid storax.		Aromatic, stimulant, and nervine.
Styrax liquida (<i>Liquidambar styraciflua</i> , Lin.)	Liquid storax.		
Suber (<i>Quercus sub.</i> Lin.)	The cork-tree.	The bark.	Astringent.

List of Simples.	TECHNICAL NAMES. ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	List of Simples.
	Succinum. Amber.		Astringent and cor- roborant.	A tincture, balsam, essential oil, and an ingredient in se- veral official preparations.	
	Sulphur. Sulphur, and flow- ers of sulphur.		Laxative, diapho- retic, and alte- rant.	Solutions in different kinds of oils called <i>balsams</i> , and an ingredient in some oint- ments.	
	Sumach (<i>Rhus co- riaria</i> , Lin.)	The leaves and seeds.	Astringent.		
	Tacamahac (<i>Popu- lus balsamifera</i> , Lin.)	The resin.	Discutient, emolli- ent, and suppu- rative.	An ingredient in several pla- sters.	
	Tamarindus (<i>T. Indica</i> , Lin.)	The fruit.	Refrigerant and laxative.	Ingredients in some laxative electuaries.	
	Tamariscus (<i>Ta- marix Gallica</i> , Lin.)	The tamarisk-tree. The leaves and bark.	Astringent.		
	Tanacetum (<i>T. vulgare</i> , Lin.)	Tansy. The leaves, flowers, and seeds.	Stimulating, anti- spasmodic, and anthelmintic.		
	Taraxacum (<i>Leon- odon tarax.</i> Lin.)	The leaves and root.	Attenuating and resolvent.	A distilled spirit, recom- mended by professor De- lius of England in asthma- tic and hydropic affec- tions.	
	Tartarum. Tartar.		Refrigerant and ca- thartic.	Purified from its earthy parts, and called <i>cream of tartar</i> , the basis of some useful pur- ging salts. An alkali is al- so prepared from it by fire.	
	Terebinthina ^a Ve- neta (<i>Pinus larix</i> , Lin.)	Venice turpentine.	} Warm stimula- ting diuretics and aperients.		
	Terebinthina Ar- gentoratensis.	Straßburgh turpen- tine.			
	Terebinthina Chia.	Chian, or Cyprus turpentine.			
	Terebinthina com- munis.	Common turpen- tine.	Used chiefly in ex- ternal applica- tions.	An essential oil. The resi- duum forms the <i>resina alba</i> <i>et nigra</i> , or white and black rosin of the shops, used in almost every ointment.	
	Terra Japonica. See <i>Catechu</i> , supra.				
	Thapsus barbatus (<i>Verapicum thap- sus</i> , Lin.)	Great white mul- lein.	The leaves and flowers.	Analeptic.	A spirituous extract from the flowers.
	Thea bohea et vi- ridis (Lin.)	Bohea and green tea.	The leaves.	Cordial, diuretic, and diaphoretic.	An infusion.
	Thlaspi (<i>T. ar- vense</i> , Lin.)	Treacle, or mithri- date mustard.	The seeds.	Aromatic and sti- mulant.	Ingredient in theriaca.
	Thus vulgare.	Common frank- incense.		Supposed corrobo- rative.	Ingredient in some warm pla- sters.
	Thymus citratus.	Lemon thyme.	The leaves.	An agreeable aro- matic.	A distilled water and essential oil.
	Thymus vulgaris.	Common thyme.	The leaves.	An agreeable aro- matic.	A distilled water and essential oil.
	Tilia (<i>T. Europaea</i> , Lin.)	The lime or linden tree.	The flowers.	Antispasmodic.	Infusion.
	Tithymalus (<i>Eup- horbia lathyris</i> , Lin.)	The spurge.	The juice of the root.	Violently cathartic.	

List of Simplex.	TECHNICAL NAMES. ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.	List of Simplex.
	Tormentilla (<i>T. erecta</i> , Lin.)	Tormentil, or sept-foil.	The root.	Astringent.	An ingredient in several official compositions.
	Trichomanes (<i>Asplenium trich.</i> , Lin.)	Maidenhair.	The herb.	Pectoral.	Decoction and syrup.
	Trifolium paludo- sum (<i>Menyanthes trifoliata</i> , Lin.)	Marsh trefoil, or buck bean.	The leaves.	Laxative and alterant.	
	Triticum (<i>T. hybernum</i> , Lin.)	Wheat.	The grain and flour.	Nutritive and glutinous.	Starch.
	Turpethum (<i>Convolvulus turpethum</i> , Lin.)	Turbith.	The root.	Violently cathartic.	An extract.
	Tussilago (<i>T. farfara</i> , Lin.)	Coltsfoot.	The leaves and flowers.	Emollient and mucilaginous.	An ingredient in pectoral decoctions.
	Tutia.	Tutty.		Ophthalmic.	Ingredient in several ointments, and collyria.
	Valeriana fylvestris (<i>Val. officinalis</i> , Lin.)	Wild valerian.	The root.	Antispasmodic.	A tincture in proof spirit, and in volatile spirit; also an ingredient in several cephalic and anti-epileptic medicines.
	Veratrum. See <i>Helleborus albus</i> , supra.				
	Verbalcum. See <i>Thapsus</i> , supra.				
	Veronica mas (<i>V. officinalis</i> , Lin.)	Male speedwell.	The leaves.	Aperient and pectoral.	Infusions.
	Vinum.	Wine.		Cordial and corroborant.	A menstruum for a great number of medicinal substances.
	Viola (<i>V. odorata</i> , Lin.)	The single violet.	The flowers.	Laxative.	A syrup.
	Vipera (<i>Coleuber berus</i> , Lin.)	The viper.	The flesh and fat.	Restorative and emollient.	A vinous tincture; an ingredient in theriaca.
	Vitis vinifera, (<i>Lin.</i>)	The vine.	The leaves, sap, flowers, and fruit.	Astringent, diuretic, aromatic, and pectoral.	Wine. The dried fruit or raisins are ingredients in some pectoral and stomachic medicines.
	Ulmus (<i>U. campestris</i> , Lin.)	The elm-tree.	The inner bark.	Astringent.	A decoction recommended by Dr Lettison in obstinate cutaneous eruptions.
	Winteranus cortex (<i>Winters aromatica</i> , Lin.)	Winter's bark.		Aromatic.	
	Urtica (<i>U. dioica</i> , Lin.)	The nettle.	The herb.	Rubefacient.	
	Uva ursi (<i>Arbutus uva ursi</i> , Lin.)	Whortle-berry.	The leaves.	Astringent and lithontriptic.	
	Zedoaria (<i>Kämpferia rotunda</i> , Lin.)	Zedoary.	The root.	Stomachic and corroborant.	An extract with proof spirit.
	Zincum.	Zinc.		Supposed to be a good antiepileptic.	The metal reduced to a calx by fire. Calamine and tutty are a kind of ores of this metal. These last are the basis of two official ointments. A salt produced by its combination with the vitriolic acid. See CHEMISTRY-Index.
	Zinziber (<i>Amomum sinzib.</i> Lin.)	Ginger.	The root.	Aromatic.	A syrup. Also an ingredient in several official compositions.

General
Titles.

General Titles including several SIMPLS.

- The five opening roots : { Smallage,
A sparagus,
Fennel,
Parley,
Butchers broom,
- The five emollient herbs : { Marshmallows,
Mallows,
Mercury,
Pellitory of the wall,
Violets.
- The four cordial flowers : { Borage,
Bugloss,
Roses,
Violets.
- The four greater hot seeds : { Anise,
Caraway,
Cummin,
Fennel.
- The four lesser hot seeds : { Bishopfeed,
Stone parley,
Smallage,
Wild carrot.
- The four greater cold seeds : { Water melons,
Cucumbers,
Gourds,
Melons.
- The four lesser cold seeds : { Succory,
Endive,
Lettuce,
Purslane.
- The four capillary herbs : { Maidenhair,
English maindenhair,
Wall rue,
Ceterach.
- The four carminative flowers : { Camomile,
Feverfew,
Dill,
Melilot.

The simples of each of the above classes have been often employed together under the respective general appellations. This practice has entirely ceased amongst us ; and accordingly these denominations are now expunged both from the London and Edinburgh pharmacopœias, and they are now retained in very few of the foreign ones. But as these articles are frequently mentioned under their general titles by writers of eminence, it was imagined that the above enumeration of them might be of some use.

GENERAL RULES for the Collection and Preservation of SIMPLS.

Roots.

Annual roots are to be taken up before they shoot
Nº 197.

out stalks or flowers : Biennial ones, chiefly in the autumn of the same year in which the seeds were sown : The perennial, when the leaves fall off, and therefore generally in the autumn. Being washed clean from dirt, and freed from the rotten and decayed fibres, they are to be hung up in a warm, shady, airy place, till sufficiently dried. The thicker roots require to be slit longitudinally, or cut transversely into thin slices. Such roots as lose their virtues by exsiccation, or are desired to be preserved in a fresh state, for the greater convenience of their use in certain forms, are to be kept buried in dry sand.

There are two seasons in which the biennial and perennial roots are reckoned the most vigorous, the autumn and spring ; or rather the time when the stalks or leaves have fallen off, and that in which the vegetation is just to begin again, or soon after it has begun ; which times are found to differ considerably in different plants.

The college of Edinburgh, in the two first editions of their pharmacopœia, directed them to be dug in the spring, after the leaves were formed ; in the third edition the autumn was preferred. The generality of roots appear, indeed, to be most efficacious in the spring : but as at this time they are also the most juicy, and consequently shrivel much in drying, and are rather more difficultly preserved, it is commonly thought most advisable to take them up in autumn. No rule, however, can be given, that shall obtain universally ; arum root is taken even in the middle of summer, without suspicion of its being less active than at other seasons ; while angelica root is inert during the summer, in comparison of what it was in the autumn, spring, or winter.

HERBS AND LEAVES.

Herbs are to be gathered when the leaves have come to their full growth, before the flowers unfold ; but of some plants the flowery tops are preferred. They are to be dried in the same manner as roots.

For the gathering of leaves, there cannot perhaps be any universal rule any more than for roots ; for though most herbs appear to be in their greatest vigour about the time of their flowering, or a little before, there are some in which the medicinal parts are more abundant at an earlier period.

Thus mallow and marshmallow leaves are most mucilaginous when young, and by the time of flowering approach more to a woody nature. A difference of the same kind is more remarkable in the leaves of certain trees and shrubs : the young buds, or rudiments of the leaves, of the black poplar tree, have a strong fragrant smell, approaching to that of storax ; but by the time that the leaves have come to their full growth, their fragrance is exhausted.

Herbs are directed by most of the pharmaceutical writers to be dried in the shade ; a rule which appears to be very just, though it has sometimes been misunderstood. They are not to be excluded from the sun's heat, but from the strong action of the solar light ; by which last their colours are more liable to be altered or destroyed than those of roots. Slow drying of them in a cool place is far from being of any advantage : both their colours and virtues are preserved in greatest perfection.

Collection,
&c. of
Samples.

Collection,
&c. of
Samples.

perfection when they are dried hastily by the heat of common fire as great as that which the sun can impart: the juicy ones, in particular, require to be dried by heat, being otherwise subject to turn black. Odoriferous herbs, dried by fire till they become friable, discover indeed, in this arid state, very little smell; not that the odorous matter is dissipated, but on account of its not being communicated from the perfectly dry subject to dry air; for as soon as a watery vehicle is supplied, whether by infusing the plant in water, or by exposing it for a little time to a moist air, the odorous parts begin to be extracted by virtue of the aqueous moisture, and discover themselves in their full force.

Of the use of heat in the drying of plants, we have an instance in the treatment of tea among the Chinese. According to the accounts of travellers, the leaves, as soon as gathered, are brought into an apartment furnished with a number of little furnaces or stoves, each of which is covered with a clean smooth iron plate; the leaves are spread on the plates, and kept rolling with the hands till they begin to curl up about the edges; they are then immediately swept off on tables, on which one person continues to roll them, while another fans them that they may cool hastily: this process is repeated two or three times, or oftener, according as the leaves are disposed to unbend on standing.

EXSICCATION OF HERBS AND FLOWERS.

Herbs and flowers are to be dried by the gentle heat of a stove or common fire, and only in that quantity at a time by which the exsiccation may be very soon finished. By this means their strength is best preserved; and this is indicated in proportion as they retain their native colour.

But the leaves of hemlock, and some other herbs replete with a subtle volatile matter, are to be powdered immediately after the exsiccation, and preserved in glass vessels, well shut.

FLOWERS.

Flowers are to be gathered when moderately expanded, on a clear dry day, before noon. Red roses are taken before they open, and the white heels clipped off and thrown away.

The quick drying, above recommended for the leaves of plants, is more particularly proper for flowers; in most of which both the colour and smell are more perishable than in leaves, and more subject to be impaired by slow exsiccation. Of the flowers which come fresh into the apothecaries hands, the only ones employed dry in the London pharmacopœia are red roses; and these, in all the compositions in which they are used in a dry state, are expressly ordered to be dried hastily. One of the most valuable aromatics of European growth, saffron, is part of a flower, dried on paper on a kind of kiln, with a heat sufficient to make it sweat, taking care only not to endanger the scorching of it.

It may here be observed, that the virtues of flowers are confined to different parts of the flower in different plants. Saffron is a singular production growing at the end of the style or pistil. The active part of

momile flowers is the yellow disk, or button in the middle: that of lilies, roses, clove-july-flowers, violets, and many others, the petala or flower-leaves; while rosemary has little virtue in any of these parts, the fragrance admired in the flowers of this plant residing chiefly in the cups.

SEEDS AND FRUITS.

Seeds should be collected when ripe, and beginning to grow dry, before they fall off spontaneously. Fruits are also to be gathered when ripe, unless otherwise ordered.

Of the fruits whose collection comes under the notice of the apothecary, there are few which are used in an unripe state; the principal is the sloe, whose virtue as a mild astringent is much diminished by maturation. The fruit of the orange tree, raised in our gardens or green-houses, is sometimes gathered in a state of much greater immaturity, soon after it is formed on the tree, before it has acquired its acid juice; at this time it proves an elegant aromatic bitter, nearly resembling what are called *Currassoe oranges*, which appear to be no other than the same fruit gathered at the same period in a warmer climate.

The rule for collecting seeds is more general than any of the others, all the official seeds being in their greatest perfection at the time of their maturity. As seeds contain little watery moisture, they require no other warmth for drying them than that of the temperate air in autumn: such as abound with a gross expressible oil, as those commonly called the *cold seeds*, should never be exposed to any considerable heat; for this would hasten the rancidity, which, however carefully kept, they are very liable to contract. Seeds are best preserved in their natural husks or coverings, which should be separated only at the time of using; the husk, or cortical part, serving to defend the seed from being injured by the air.

WOODS AND BARKS.

The most proper season for the felling of woods, or shaving off their barks, is generally the winter.

No woods of our own growth are now retained by the London or Edinburgh colleges. The only two which had formerly a place in the catalogues of simples were the juniper and the box; the first of which is never kept in the shops, or employed in practice; the other may be procured from the turner; and it is indifferent at what season it has been cut down, being at all times sufficiently fit for the only use to which it was applied, the yielding an empyreumatic oil by distillation in a strong fire.

It may be doubted, whether barks are not generally more replete with medicinal matter in summer and spring than in winter. The barks of many trees are in summer so much loaded with resin and gum as to burst spontaneously, and discharge the redundant quantity. It is said that the bark of the oak answers best for the tanners at the time of the rising of the sap in spring: and as its use in tanning depends on the same astringent quality for which it is used in medicine, it should seem to be also fittest for medicinal purposes in the spring. It may be observed likewise, that it is in

Collection, this last season that barks in general are most convenient
 &c. of peeled off.
 Simples.

ANIMAL SUBSTANCES.

Animal substances are to be chosen in their

most perfect state, unless they be ordered otherwise.
 Collection
 &c. of
 Simples.

Whatever virtues these bodies may have, they are supposed to be best when they have attained to their common full growth.

M A T

Material
 ||
 Mathematics.

MATERIAL, denotes something composed of matter. In which sense the word stands opposed to immaterial. See MATTER and METAPHYSICS.

MATERIALISTS, a sect in the ancient church, composed of persons who, being prepossessed with that maxim in the ancient philosophy, *Ex nihilo nihil fit*, "Out of nothing nothing can arise," had recourse to an internal matter, on which they supposed God wrought in the creation; instead of admitting God alone as the sole cause of the existence of all things. Tertullian vigorously opposes the doctrine of the materialists in his treatise against Hermogenes, who was one of their number.

Materialists is also a name given to those who maintain that the soul of man is material; or that the principle of perception and thought is not a substance distinct from the body, but the result of corporeal organization: See METAPHYSICS. There are others, called by this name, who have maintained that there is nothing but matter in the universe; and that the Deity himself is material. See SPINOZISM.

MATHAM (Jaques), an engraver of considerable eminence, was born at Haerlem in 1571, and after the death of his father, Henry Goltzius, a celebrated painter and engraver, married his mother. From his father-in-law he learned the art of engraving. He went to Italy, to complete his studies from the works of the greatest masters; and in that country he engraved a considerable number of plates. At his return, he worked under the eye of Goltzius, and produced many very valuable prints. Following the example of his father-in-law, he worked entirely with the graver, in a clear, free style; and though he never equalled him in point of taste or correctness of drawing, especially when confined to the naked parts of the human figure, most of his prints are greatly esteemed.

MATHEMATICS, the science of quantity; or a science that considers magnitudes either as computable or measurable.

The word in its original, μαθηματις, signifies discipline, or science in the general; and seems to have been applied to the doctrine of quantity, either by way of eminence, or because, this having the start of all other sciences, the rest took their common name therefrom. See SCIENCE.

For the origin of the mathematics, Josephus dates it before the flood, and makes the sons of Seth observers of the course and order of the heavenly bodies: he adds, that, to perpetuate their discoveries, and secure them from the injuries either of a deluge or a conflagration, they had them engraven on two pillars, the one of stone, the other of brick; the former of which he says was standing in Syria in his days. See ASTRONOMY.

The first who cultivated mathematics after the flood

M A T

Mathematics.

were the Assyrians and Chaldeans; from whom, the same Josephus adds, they were carried by Abraham to the Egyptians; who proved such notable proficient, that Aristotle makes no scruple to fix the first rise of mathematics among them. From Egypt, 584 years before Christ, they passed into Greece through the hands of Thales; who having learned geometry of the Egyptian priests, taught it in his own country. After Thales, comes Pythagoras; who, among other mathematical arts, paid a particular regard to arithmetic; fetching the greatest part of his philosophy from numbers: he was the first, as Lactius tells us, who abstracted geometry from matter; and to him we owe the doctrine of incommensurable magnitude, and the five regular bodies, besides the first principles of music and astronomy. Pythagoras was seconded by Anaxagoras, Cænopides, Bristo, Antipho, and Hippocrates of Scio; who all applied themselves particularly to the quadrature of the circle, the duplicature of the cube, &c. but the last with most success: this last is also mentioned by Proclus, as the first who compiled elements of mathematics.

Democritus excelled in mathematics as well as physics; though none of his works in either kind are extant, the destruction of which some authors lay at Aristotle's door. The next in order is Plato, who not only improved geometry, but introduced it into physics, and so laid the foundation of a solid philosophy. Out of his school proceeded a crowd of mathematicians. Proclus mentions 13 of note; among whom was Leodamus, who improved the analysis first invented by Plato; Theætetus, who wrote elements; and Archimedes, who has the credit of being the first who applied mathematics to use in life. These were succeeded by Neocles and Theon, the last of whom contributed to the elements. Eudoxus excelled in arithmetic and geometry, and was the first founder of a system of astronomy. Menechmus invented the conic sections, and Theudius and Hermotimus improved the elements.

For Aristotle, his works are so stored with mathematics, that Blancanus compiled a whole book of them: out of his school came Eudemus and Theophrastus; the first of whom wrote of numbers, geometry, and invisible lines; the latter, a mathematical history. To Aristotle, Idorus, and Hypicles, we owe the books of solids; which, with the other books of elements, were improved, collected, and methodised by Euclid, who died 284 years before Christ.

An hundred years after Euclid, came Eratosthenes and Archimedes. Cotemporary with the latter was Conon, a geometrician and astronomer. Soon after came Apollonius Pergæus; whose conics are still extant. To him are likewise ascribed the 14th and 15th books of Euclid, which are said to have been contracted

ted by Hippicles. Hipparchus and Menelaus wrote on the spherics in a circle, the latter also on spherical triangles: Theodosius's three books of spherics are still extant. And all these, Menelaus excepted, lived before Christ.

A. D. 70. Ptolemy of Alexandria was born; the prince of astronomers, and no mean geometrician: he was succeeded by the philosopher Plutarch, of whom we have still extant some mathematical problems. After him came Eutocius, who commented on Archimedes, and occasionally mentions the inventions of Philo, Diocles, Nicomedes, Sporus, and Heron, on the duplicature of the cube. To Ctesibius of Alexandria we owe our pumps; and Geminus, who came soon after, is preferred by Proclus to Euclid himself.

Diophantus of Alexandria was a great master of numbers, and the first inventor of algebra: among others of the ancients, Nicomachus is celebrated for his arithmetical, geometrical, and musical works; Serenus, for his books on the sections of the cylinder; Proclus, for his comments on Euclid; and Theon has the credit, among some, of being author of the books of elements ascribed to Euclid. The last to be named among the ancients, is Pappus of Alexandria, who flourished A. D. 400, and is celebrated for his books of mathematical collections still extant.

Mathematics are commonly distinguished into *pure and speculative*, which consider quantity abstractedly; and *mixed*, which treat of magnitude as subsisting in material bodies, and consequently are interwoven every where with physical considerations.

Mixed mathematics are very comprehensive; since to them may be referred astronomy, optics, geography, hydrostatics, mechanics, fortification, navigation, &c. See the articles ASTRONOMY, OPTICS, &c.

Pure mathematics have one peculiar advantage, that they occasion no disputes among wrangling disputants, as in other branches of knowledge; and the reason is, because the definitions of the terms are premised, and every body that reads a proposition has the same idea of every part of it. Hence it is easy to put an end to all mathematical controversies, by showing, either that our adversary has not stuck to his definitions, or has not laid down true premises, or else that he has drawn false conclusions from true principles; and in case we are able to do neither of these, we must acknowledge the truth of what he has proved.

It is true, that in mixed mathematics, where we reason mathematically upon physical subjects, we cannot give such just definitions as the geometricians: we must therefore rest content with descriptions; and they will be of the same use as definitions, provided we are consistent with ourselves, and always mean the same thing by those terms we have once explained.

Dr Barrow gives a most elegant description of the excellence and usefulness of mathematical knowledge, in his inaugural oration, upon being appointed professor of mathematics at Cambridge.

The mathematicians, he observes, effectually exercise, not vainly delude, nor vexatiously torment, studious minds with obscure subtilties; but plainly demonstrate every thing within their reach, draw certain conclusions, instruct by profitable rules, and unfold pleasant questions. These disciplines likewise enure and corro-

borate the mind to a constant diligence in study; they wholly deliver us from a credulous simplicity, most strongly fortify us against the vanity of scepticism, effectually restrain us from a rash presumption, most easily incline us to a due assent, and perfectly subject us to the government of right reason. While the mind is abstracted and elevated from sensible matter, daintily views pure forms, conceives the beauty of ideas, and investigates the harmony of proportions; the manners themselves are sensibly corrected and improved, the affections composed and rectified, the fancy calmed and settled, and the understanding raised and excited to more divine contemplations.

MATHEMATICAL, any thing belonging to the science of mathematics.

MATHEMATICAL Instruments, such instruments as are usually employed by mathematicians, as compasses, scales, quadrants, &c.

Machine for dividing MATHEMATICAL Instruments. See RAMSDEN'S Machine.

MATHER (Dr Cotton), an eminent American divine, born at Boston in New England in the year 1663. He was educated in Harvard college, and in 1684 became minister of Boston; in the diligent discharge of which office he spent his life, and promoted several excellent societies for the public good: particularly one for suppressing disorders, one for reforming manners, and a society of peace-makers, whose professed business it was to compose differences and prevent law-suits. His reputation was not confined to his own country: for in 1710, the university of Glasgow sent him a diploma for the degree of doctor in divinity; and, in 1714, the Royal Society of London chose him one of their fellows. He died in 1728; and is said to have published in his lifetime 382 pieces, including single sermons, essays, &c. yet several were of a larger size, among which was *Magna Christi Americana*, or an Ecclesiastical History of New-England, from its first planting in 1620 to 1698, folio. But the most remarkable of all his works was that in which, like Glanville, he defended the doctrine of witchcraft. We shall content ourselves with giving the title at large, which is as follows: "The wonders of the invisible world; being an account of the trials of several witches lately executed in New-England, and of several remarkable curiosities therein occurring. Together with, 1. Observations on the nature, the number, and the operations of the devils. 2. A short narrative of a late outrage committed by a knot of witches in Swedenland; very much resembling, and so far explaining that under which New-England has laboured. 3. Some counsels directing a due improvement of the terrible things lately done by the unusual and amazing range of evil spirits in New-England. 4. A brief discourse upon the temptations which are the more ordinary devices of Satan. By Cotton Mather; published by the special command of his excellency the governor of the province of Massachusetts's Bay in New-England." Printed first at Boston in New-England, and reprinted at London, in 1736, 4to.

MATLOCK, a town or village of Derbyshire, near Wickford, situated on the very edge of the Derwent; noted for its bath, the water of which is milk-warm; and remarkable for the huge rocks in its environs,

Matras
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Matrice.

virons, particularly those called the *Torr*, on the east side of the Derwent, over against it, which seem to be piled one upon another. It is an extensive straggling village, built in a very romantic style, on the steep side of a mountain, rising irregularly from the bottom to nearly the summit. Near the bath are several small houses, whose situation is on the little natural horizontal parts of the mountain, a few yards above the road, and in some places the roofs of some almost touch the floors of others. There are excellent accommodations for company who resort to the bath; and the poorer inhabitants are supported by the sale of petrifications, crystals, &c. and notwithstanding the rockiness of the soil, the cliffs produce an immense number of trees, whose foliage adds greatly to the beauty of the place.

MATRASS, CUCURBIT, or BOLT-HEAD, among chemists. See CHEMISTRY, n° 579.

MATRICARIA, FEVERFEW, in botany: A genus of the polygama superflua order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The receptacle is naked; there is no pappus; the calyx hemispherical and imbricated, with the marginal leaflets solid, and something sharp. There are five species, but the only remarkable one is the parenthesis or common feverfew. This hath very fibrous clustering roots, crowned with numerous compound leaves; upright stalks branching on every side two or three feet high; garnished with compound plain leaves of seven oval folioles, cut into many parts; and all the branches terminated by many compound radiated white flowers having a yellow disk. There are varieties with double flowers, with semi-double flowers, with double fistular flowers, with a fistular disk and plain radius, with short-rayed flowers, with rayless flowers, with rayless sulphur-coloured heads, and with finely curled leaves. — All these varieties flower abundantly in June, each flower being composed of numerous hermaphrodite and female florets; the former compose the disk, the latter the radius or border, and which, in the double and fistular kinds, are very ornamental in gardens, but of a disagreeable odour; and are all succeeded by plenty of seed in autumn, by which they are easily propagated, as well as by parting the roots and cuttings.

Medical uses. This plant has received a most extraordinary character in hyssic and other affections of the nerves, as well as for being a carminative or warm stimulating bitter. Dr Lewis, however, thinks it inferior to camomile; with which he says it agrees in all its sensible qualities, only being somewhat weaker.

MATRICE, or MATRIX. See MATRIX.

MATRICE, or matrix, in dyeing, is applied to the five simple colours, whence all the rest are derived or composed. These are, the black, white, blue, red, and yellow or root colour.

MATRICE, or matrices, used by the letter-founders, are those little pieces of copper or brass, at one end whereof are engraven, dent-wise, or *en creux*, the several characters used in the composing of books. Each character, virgula, and even each point in a discourse, has its several matrix; and of consequence, its several puncheon to strike it. They are the engravers on metal that cut or grave the matrices.

Matrice
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Matrona.

When types are to be cast, the matrice is fastened to the end of a mould, so disposed as that when the metal is poured on it, it may fall into the creux or cavity of the matrice, and take the figure and impression thereof. See *Letter-Foundery*.

MATRICES, used in coining, are pieces of steel in form of dyes, whereon are engraven the several figures, arms, characters, legends, &c. wherewith the species are to be stamped. The engraving is performed with several puncheons, which being formed in relieve, or prominent, when struck on the metal, make an indented impression, which the French call *en creux*.

MATRICULA, a register kept of the admission of officers and persons entered into any body or society whereof a list is made. Hence those who are admitted into our universities are said to be matriculated. Among ecclesiastical authors, we find mention made of two kinds of matriculæ; the one containing a list of the ecclesiastics called *matricula clericorum*; the other of the poor sublisted at the expence of the church, called *matricula pauperum*.

MATRICULA was also applied to a kind of almshouse, where the poor were provided for. It had certain revenues appropriated to it, and was usually built near the church; whence the name was also frequently given to the church itself.

MATRIMONY. See MARRIAGE.

MATRIX, in anatomy, the womb, or that part of the female of any kind, wherein the fetus is conceived and nourished till the time of its delivery. See ANATOMY, n° 108.

MATRIX is also applied to places proper for the generation of vegetables, minerals, and metals. Thus the earth is the matrix wherein seeds sprout; and marcasites are by many considered as the matrices of metals.

The matrix of ores is the earthy and stony substances in which these metallic matters are enveloped: these are very various, frequently spar, quartz, fluors, or horn-blend.

MATRON, an elderly married woman.

Jury of MATRONS. When a widow feigns herself with child in order to exclude the next heir, and a supposititious birth is suspected to be intended, then, upon the writ de *ventre inspiciendo*, a jury of women is to be impanelled to try the question whether the woman is with child or not. So, if a woman is convicted of a capital offence, and, being condemned to suffer death, pleads in stay of execution, that she is pregnant, a jury of matrons is impanelled to inquire into the truth of the allegation; and, if they find it true, the convict is respited till after her delivery.

MATRONA, (anc. geog.), a river separating Gallia Celtica from the Belgica (Cesar.) Now the Marne; which, rising in Champaign near Langres, runs north-west, and then west, and passing by Meaux falls into the Seine at Charenton, two leagues to the east of Paris.

MATRONALIA, a Roman festival instituted by Romulus, and celebrated on the kalends of March, in honour of Mars. It was kept by matrons in particular, and bachelors were entirely excluded from any share in the solemnity. The men during this feast sent presents to the women, for which a return was made.

Matroses
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Matter.

made by them at the Saturnalia: And the women gave the same indulgence to their servants; now which the men gave to theirs at the feast of Saturn, serving them at table, and treating them as superiors.

MATROSSES, are soldiers in the train of artillery, who are next to the gunners, and assist them in loading, firing, and sponging the great guns. They carry firelocks, and march along with the store-waggons, both as a guard, and to give their assistance in case a waggon should break down.

MATSYS (Quintin), painter of history and portraits, was born at Antwerp in 1460, and for several years followed the trade of a blacksmith or farrier, at least till he was in his 20th year. Authors vary in their accounts of the cause of his quitting his first occupation, and attaching himself to the art of painting. Some affirm, that the first unfolding of his genius was occasioned by the sight of a print which accidentally was shown to him by a friend who came to pay him a visit while he was in a declining state of health from the labour of his former employment, and that by his copying the print with some degree of success, he was animated with a desire to learn the art of painting. Others say, he fell in love with a young woman of great beauty, the daughter of a painter, and they allege that love alone wrought the miracle, as he could have no prospect of obtaining her except by a distinguished merit in the profession of painting: for which reason he applied himself with incessant labour to study and practise the art, till he became so eminent as to be intitled to demand her in marriage, and he succeeded. Whatever truth may be in either of these accounts, it is certain that he appeared to have an uncommon genius; his manner was singular, not resembling the manner of any other master, and his pictures were strongly coloured and carefully finished, but yet they have somewhat dry and hard. By many competent judges it was believed, when they observed the strength of expression in some of his compositions, that if he had studied in Italy to acquire some knowledge of the antiques and the great masters of the Roman school, he would have proved one of the most eminent painters of the Low Countries. But he only imitated ordinary life; and seemed more inclined, or at least more qualified, to imitate the defects than the beauties of nature. Some historical compositions of this master deserve commendation; particularly a descent from the cross, which is in the cathedral at Antwerp; and it is justly admired for the spirit, skill, and delicacy of the whole. But the most remarkable and best known picture of Matsys, is that of the two misers in the gallery at Windsor. He died in 1529. He had a son, John; who painted in the same style and manner, but not with a reputation equal to his father; though many of his pictures are sold to unskilful purchasers for the paintings of Quintin. His most frequent subject was the representation of misers counting their gold, or bankers examining and weighing it.

MATT, in a ship, is a name given to rope-yarn, junk, &c. beat flat and interwoven; used in order to preserve the yards from galling or rubbing in hoisting or lowering them.

MATTER, in common language, is a word of the same import with *body*, and denotes that which is tan-

gible, visible, and extended; but among philosophers it signifies that substance of which all bodies are composed; and in this sense it is synonymous with the word *ELEMENT*.

It is only by the senses that we have any communication with the external world; but the immediate objects of sense, philosophers have in general agreed to term *qualities*, which they conceive as inhering in something which is called their *subject* or *substratum*. It is this substratum of sensible qualities which, in the language of philosophy, is denominated *matter*; so that *matter* is not that which we immediately see or handle, but the *concealed subject* or *support* of visible and tangible qualities. What the moderns term *qualities*, was by Aristotle and his followers called *form*; but so far as the two doctrines are intelligible, there appears to be no essential difference between them. From the moderns we learn, that body consists of *matter* and *qualities*; and the Peripatetics taught the same thing, when they said that body is composed of *matter* and *form*.

How philosophers were led to analyse body into matter and form, or, to use modern language, into matter and qualities; what kind of existence they attribute to each; and whether *matter* must be conceived as self-existent or created—are questions which shall be considered afterwards (See METAPHYSICS). It is sufficient here to have defined the term.

MATTHEW, or Gospel of St MATTHEW, a canonical book of the New Testament.

St MATTHEW wrote his gospel in Judæa, at the request of those he had converted; and it is thought he began in the year 41, eight years after Christ's resurrection. It was written, according to the testimony of all the ancients, in the Hebrew or Syriac language; but the Greek version, which now passes for the original, is as old as the apostolical times.

St MATTHEW the Evangelist's Day, a festival of the Christian church, observed on September 21st.

St MATTHEW, the son of Alphaeus, was also called *Levi*. He was of Jewish original, as both his names discover, and probably a Galilean. Before his call to the apostolate, he was a publican or toll-gatherer to the Romans: an office of bad repute among the Jews, on account of the covetousness and exaction of those who managed it; St Matthew's office particularly consisting in gathering the customs of all merchandize that came by the sea of Galilee, and the tribute that passengers were to pay who went by water. And here it was that Matthew sat at the receipt of custom, when our Saviour called him to be a disciple. It is probable, that, living at Capernaum, the place of Christ's usual residence, he might have some knowledge of him before he was called. Matthew immediately expressed his satisfaction in being called to this high dignity, by entertaining our Saviour and his disciples at a great dinner at his own house, whither he invited all his friends, especially those of his own profession, hoping, probably, that they might be influenced by the company and conversation of Christ. St Matthew continued with the rest of the apostles till after our Lord's ascension. For the first eight years afterwards, he preached in Judæa. Then he betook himself to propagating the gospel among the Gentiles.

Mathew.

Matthew
Mattiacum

Gentiles, and chose *ATHIAS* as the scene of his apostolical ministry; where it is said he suffered martyrdom, but by what kind of death is altogether uncertain. It is pretended, but without any foundation, that Hyrtacus, king of Ethiopia, desiring to marry Iphigenia, the daughter of his brother and predecessor *Æglippus*, and the apostle having represented to him that he could not lawfully do it, the enraged prince ordered his head immediately to be cut off. Baronius tells us, the body of St Matthew was transported from Ethiopia to Bithynia, and from thence was carried to Salerno in the kingdom of Naples in the year 954, where it was found in 1080, and where duke Robert built a church bearing his name.

ST MATTHEW, a town of Spain, in the kingdom of Arragon, situate in a pleasant plain, and in a very fertile country watered with many springs. W. Long. c. 16. N. Lat. 40. 22.

MATTHEW of Paris. See *PARIS*.

MATTHEW of Westminster, a Benedictine monk and accomplished scholar, who wrote a history from the beginning of the world to the end of the reign of Edward I. under the title of *Flores Historiarum*; which was afterwards continued by other hands. He died in 1380.

St *MATTHIAS*, an apostle, was chosen instead of Judas. He preached in Judæa and part of *Æthiopia*, and suffered martyrdom. See the *Acts of the Apostles*, chap. i. There was a gospel published under Matthias's name, but rejected as spurious; as likewise some traditions, which met with the same fate.

St Matthias's Day; a festival of the Christian church, observed on the 24th of February. St Matthias was an apostle of Jesus Christ, but not of the number of the twelve chosen by Christ himself. He obtained this high honour upon a vacancy made in the college of the apostles by the treason and death of Judas Iscariot. The choice fell on Matthias by lot; his competitor being Joseph called *Barabas*, and surnamed *Justus*. Matthias was qualified for the apostleship, by having been a constant attendant upon our Saviour all the time of his ministry. He was, probably, one of the 70 disciples. After our Lord's resurrection, he preached the gospel first in Judæa. Afterwards it is probable he travelled eastwards, his residence being principally near the irruption of the river *Apaurus* and the haven *Hyflus*. The barbarous people treated him with great rudeness and inhumanity; and, after many labours and sufferings in converting great numbers to Christianity, he obtained the crown of martyrdom; but by what kind of death, is uncertain.—They pretend to show the relics of St Matthias at Rome; and the famous abbey of St Matthias near Treves boasts of the same advantage; but doubtless both without any foundation. There was a gospel ascribed to St Matthias; but it was universally rejected as spurious.

MATTIACÆ AQUÆ, or *MATTIACI FONTES*, (anc. geog.), now Wisbaden, opposite to Mentz, in the *Vetervaria*. E. Long. 8. N. Lat. 50. 6.

MATTIACUM, or *MATTIUM*, (anc. geog.), a town of the Mattiaci, a branch of the Catti in Germany. Now Marburg in Hesse. E. Long. 8. 40. N. Lat. 50. 40.

Matthews
Matty.

MATTEWS, the first canonical hour, or the first part of the daily service, in the Roman church.

MATTHIOLUS (Peter Andrew), an eminent physician in the 16th century, born at Sienna, was well skilled in the Greek and Latin tongues. He wrote learned commentaries on *Dioscorides*, and other works which are esteemed; and died in 1577.

MATURANT'S, in pharmacy, medicines which promote the supuration of tumors.

MATY (Matthew), M. D. an eminent physician and polite writer, was born in Holland in the year 1718. He was the son of a clergyman, and was originally intended for the church; but in consequence of some mortifications his father met with from the synod, on account of some particular sentiments he entertained about the doctrine of the Trinity, turned his thoughts to physic. He took his degree of M. D. at Leyden; and in 1740 came to settle in England, his father having determined to quit Holland for ever. In order to make himself known, in 1749 he began to publish in French an account of the productions of the English press, printed at the Hague under the name of the *Journal Britannique*. This journal, which continues to hold its rank amongst the best of those which have appeared since the time of Bayle, answered the chief end he intended by it, and introduced him to the acquaintance of some of the most respectable literary characters of the country he had made his own. It was to their active and uninterrupted friendship he owed the places he afterwards possessed. In 1758 he was chosen fellow; and in 1765, on the resignation of Dr Birch, who died a few months after and made him his executor, secretary to the royal society. He had been appointed one of the under librarians of the British museum at its first institution in 1753, and became principal librarian at the death of Dr Knight in 1772. Useful in all these posts, he promised to be eminently so in the last, when he was seized with a languishing disorder, which in 1776 put an end to a life which had been uniformly devoted to the pursuit of science and the offices of humanity. He was an early and active advocate for inoculation; and when there was a doubt entertained that one might have the small-pox this way a second time, tried it upon himself unknown to his family. He was a member of the medical club (with the Drs Parsons, Templeman, Fothergill, Watson, and others), which met every fortnight in St Paul's churchyard. He was twice married, viz. the first time to Mrs Elizabeth Boisragon; and the second to Mrs Mary Deners. He left a son and three daughters. He had nearly finished the *Memoirs of the Earl of Chesterfield*; which were completed by his son-in-law Mr Justamond, and prefixed to that nobleman's *Miscellaneous Works*, 1777, 2 vols 4to.

MATY (Paul Henry), M. A. F. R. S. son of the former, was educated at Westminster and Trinity college Cambridge, and had his travelling fellowship for three years. He was afterwards chaplain to Lord Stormont at Paris in 17... and soon after vacated his next fellowship by marrying one of the three daughters of Joseph Clark, Esq; sister of the late Captain Charles Clark (who succeeded to the command on the death of Captain Cook). On his father's death in 1776, he succeeded to the office of one of the under librarians of

Maty
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Maupertuis.

of the British museum, and was afterwards preferred to a superior department, having the care of the antiquities, for which he was eminently well qualified. In 1776 he also succeeded his father in the office of secretary to the royal society. On the disputes respecting the reinstatement of Dr Hutton in the department of secretary for foreign correspondence 1784, Mr Maty took a warm and distinguished part, and resigned the office of secretary; after which he undertook to assist gentlemen or ladies in perfecting their knowledge of the Greek, Latin, French, and Italian classes. Mr Maty was a thinking conscientious man; and having conceived some doubts about the articles he had subscribed in early life, he never could be prevailed upon to place himself in the way of ecclesiastical preferment, though his connections were amongst those who could have served him essentially in this point; and soon after his father's death he withdrew himself from ministering in the established church, his reasons for which he published in the 47th volume of the *Genl. Magazine*, p. 466. His whole life was thence forwards taken up in literary pursuits. He received 100*l.* from the duke of Marlborough, with a copy of that beautiful work the *Gemma Marburienses*, of which only 100 copies were worked off for presents; and of which Mr Maty wrote the French account, as Mr Bryant did the Latin. In January 1782 he set on foot a *Review* of publications, principally foreign, which he carried on, with great credit to himself and satisfaction to the public, for near five years, when he was obliged to discontinue it from ill health. He had long laboured under an asthmatic complaint, which at times made great ravages in his constitution, and at last put a period to his life in Jan. 1787, at the age of 42; leaving behind him one son.—Mr Maty enjoyed a respectable rank in the republic of letters, and by his talents and attainments was fully intitled to it. He was eminently acquainted with ancient and modern literature, and particularly conversant in critical researches. The purity and probity of his nature were unquestionable; and his humanity was as exquisite as it would have been extensive, had it been seconded by his fortune.

MAUCAUCO, MACACO, or *Maki*, in zoology. See *LEMUR*, n° 4.

MAVIS, in ornithology, a species of *turdus*. See *TURDUS*.

MAUBEUGE, a town of the Netherlands, in Hainault, with an illustrious abbey of canonesses, who must be noble both by the father and mother's side. This place was ceded to France in 1678; and fortified after the manner of Vauban. It is seated on the river Sambre, in E. Long. 5. o. N. Lat. 50. 15.

MAUNCH, in heraldry, the figure of an ancient coat sleeve, borne in many gentlemen's escutcheons.

MAUNDY THURSDAY, is the Thursday in Passion week; which was called *Maudy* or *Mandate Thursday*, from the command which our Saviour gave his apostles to commemorate him in the Lord's supper, which he this day instituted; or from the new commandment which he gave them to love one another, after he had washed their feet as a token of his love to them.

MAUPERTUIS (Peter Louis Moreau de), a celebrated French academician, was born at St Malo in 1698; and was there privately educated till he arrived

Maupertuis.

at his 16th year, when he was placed under the celebrated professor of philosophy M. le Blond, in the college of la Marche, at Paris. He soon discovered a passion for mathematical studies, and particularly for geometry. He likewise practised instrumental music in his early years with great success; but fixed on no profession till he was 20, when he entered into the army. He first served in the Grey Mousquetaers; but in the year 1720, his father purchased him a company of cavalry in the regiment of La Roche Guyon. He remained but five years in the army, during which time he pursued his mathematical studies with great vigour; and it was soon remarked by M. Freret and other academicians, that nothing but geometry could satisfy his active soul and unbounded thirst for knowledge. In the year 1723, he was received into the Royal Academy of Sciences, and read his first performance, which was a memoir upon the construction and form of musical instruments, November 15. 1724. During the first years of his admission he did not wholly confine his attention to mathematics; he dived into natural philosophy, and discovered great knowledge and dexterity in observations and experiments upon animals. If the custom of travelling into remote climates, like the sages of antiquity, in order to be initiated into the learned mysteries of those times, had still subsisted, no one would have conformed to it with greater eagerness than M. de Maupertuis. His first gratification of this passion was to visit the country which had given birth to Newton; and during his residence at London he became as zealous an admirer and follower of that philosopher as of any one of his own countrymen. His next excursion was to Basil in Switzerland, where he formed a friendship with the famous John Bernoulli and his family, which continued to his death. At his return to Paris, he applied himself to his favourite studies with greater zeal than ever:—And how well he fulfilled the duties of an academician, may be gathered by running over the memoirs of the academy from the year 1724 to 1736; where it appears that he was neither idle nor occupied by objects of small importance. The most sublime questions in geometry and the relative sciences received from his hands that elegance, clearness, and precision, so remarkable in all his writings. In the year 1736, he was sent by the king of France to the polar circle, to measure a degree in order to ascertain the figure of the earth, accompanied by Messrs Clairault, Camus, Le Monnier, l'Abbé Outhier, and Celsius the celebrated professor of astronomy at Upsal. This distinction rendered him so famous, that, at his return, he was admitted a member of almost every academy in Europe.

In the year 1740 Maupertuis had an invitation from the king of Prussia to go to Berlin; which was too flattering to be refused. His rank among men of letters had not wholly effaced his love for his first profession, namely, that of arms. He followed his Prussian majesty into the field, and was a witness of the dispositions and operations that preceded the battle of Moltwitz; but was deprived of the glory of being present, when victory declared in favour of his royal patron, by a singular kind of adventure. His horse, during the heat of the action, running away with him, he fell into the hands of the enemy; and was at first

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Mau-
perts.

but roughly treated by the Austrian soldiers, to whom he could not make himself known for want of language; but being carried prisoner to Vienna, he received such honours from their imperial majesties as were never effaced from his memory. From Vienna he returned to Berlin; but as the reform of the academy which the king of Prussia then meditated was not yet mature, he went again to Paris, where his affairs called him, and was chosen in 1742 director of the academy of sciences. In 1743 he was received into the French academy; which was the first instance of the same person being a member of both the academies at Paris at the same time. M. de Maupertuis again assumed the soldier at the siege of Fribourg, and was pitched upon by marshal Cigny and the count d'Argenson to carry the news to the French king of the surrender of that citadel.

He returned to Berlin in the year 1744, when a marriage was negotiated and brought about, by the good offices of the queen-mother, between our author and mademoiselle de Borck, a lady of great beauty and merit, and nearly related to M. de Borck at that time minister of state. This determined him to settle at Berlin, as he was extremely attached to his new spouse, and regarded this alliance as the most fortunate circumstance of his life.

In the year 1746, M. de Maupertuis was declared by his Prussian majesty president of the royal academy of sciences at Berlin, and soon after by the same prince was honoured with the order of Merit: However, all these accumulated honours and advantages, so far from lessening his ardour for the sciences, seemed to furnish new allurements to labour and application. Not a day passed but he produced some new project or essay for the advancement of knowledge. Nor did he confine himself to mathematical studies only: metaphysics, chemistry, botany, polite literature, all shared his attention, and contributed to his fame. At the same time, he had, it seems, a strange inquietude of spirit, with a dark atrabilaire humour, which rendered him miserable amidst honours and pleasures. Such a temperament did not promise a very pacific life; and he was engaged in several quarrels. He had a quarrel with Koenig the professor of philosophy at Franeker, and another more terrible with Voltaire. Maupertuis had inserted into the volume of *Memoirs of the Academy of Berlin* for 1746, a discourse upon the laws of motion; which Koenig was not content with attacking, but attributed to Leibnitz. Maupertuis, stung with the imputation of plagiarism, engaged the academy of Berlin to call upon him for his proof; which Koenig failing to produce, he was struck out of the academy, of which he was a member. Several pamphlets were the consequence of this; and Voltaire, for some reason or other, engaged against Maupertuis. We say, for some reason or other: because Maupertuis and Voltaire were apparently upon the most amicable terms; and the latter respected the former as his master in the mathematics. Voltaire, however, exerted all his wit and satire against him; and on the whole was so much transported beyond what was thought right, that he found it expedient in 1753 to quit the court of Prussia.

Our philosopher's constitution had long been considerably impaired by the great fatigues of various kinds
N^o 193.

Mau-
perts.

in which his active mind had involved him; though from the amazing hardships he had undergone in his northern expedition, most of his future bodily sufferings may be traced. The intense sharpness of the air could only be supported by means of strong liquors; which helped but to lacerate his lungs, and bring on a spitting of blood, which began at least 12 years before he died. Yet still his mind seemed to enjoy the greatest vigour; for the best of his writings were produced, and most sublime ideas developed, during the time of his confinement by sickness, when he was unable to occupy his prefdial chair at the academy. He took several journeys to St Malo, during the last years of his life, for the recovery of his health: And though he always received benefit by breathing his native air, yet still, upon his return to Berlin, his disorder likewise returned with greater violence.—His last journey into France was undertaken in the year 1757; when he was obliged, soon after his arrival there, to quit his favourite retreat at St Malo, on account of the danger and confusion which that town was thrown into by the arrival of the English in its neighbourhood. From thence he went to Bourdeaux, hoping there to meet with a neutral ship to carry him to Hamburg, in his way back to Berlin; but being disappointed in that hope, he went to Toulouse, where he remained seven months. He had then thoughts of going to Italy, in hopes a milder climate would restore him to health; but finding himself grow worse, he rather inclined towards Germany, and went to Neuchatel, where for three months he enjoyed the conversation of Lord Marischal, with whom he had formerly been much connected. At length he arrived at Basil, October 16. 1758, where he was received by his friend Bernouilli and his family with the utmost tenderness and affection. He at first found himself much better here than he had been at Neuchatel; but this amendment was of short duration; for as the winter approached, his disorder returned, accompanied by new and more alarming symptoms. He languished here many months, during which he was attended by M. de la Coudamie; and died in 1759.

He wrote in French, 1. The figure of the earth determined. 2. The measure of a degree of the meridian. 3. A discourse on the parallax of the moon. 4. A discourse on the figure of the stars. 5. The elements of geography. 6. Nautical astronomy. 7. Elements of astronomy. 8. A physical dissertation on a white inhabitant of Africa. 9. An essay on cosmography. 10. Reflections on the origin of languages. 11. An essay on moral philosophy. 12. A letter on the progress of the sciences. 13. An essay on the formation of bodies. 14. An eulogium on M. de Montequieu. 15. Letters, and other works.

MAUR (St), was a celebrated disciple of St Benedict. If we can believe a life of St Maur ascribed to Faustus his companion, he was sent by Benedict on a mission to France. But this life is considered as apocryphal. In rejecting it, however, as well as the circumstances of the mission, we must beware of denying the mission itself. It is certain that it was believed in France as early as the 9th century; and notwithstanding the silence of Bede, Gregory of Tours, and others, there are several documents which prove this, or at least render it extremely probable. A celebrated society

Mauriceau
Maurice.

Maurice.

ciety of benedictines took the name of *St Maur* in the beginning of the last century, and received the sanction of Pope Gregory XV. in 1621. This society was early distinguished by the virtue and the knowledge of its members, and it still supports the character. There are perhaps fewer eminent men in it than formerly; but this must be ascribed to the levity of the age, and partly to the little encouragement for the researches of learned men. The chief persons of ingenuity which this society has produced are, the Fathers Menard, d'Acheri, Mabillon, Ruinart, Germain, Lami, Montfaucon, Martin, Vaissette, le Nourri, Martianay, Martenne, Maffuet, &c. &c. See *L'Histoire Litteraire de la Congregation de St. Maur*, published at Paris under the title of *Brussels*, in 4to, 1770, by Dom. Tassin.

MAURICEAU (Francis), a French surgeon, who applied himself with great success and reputation to the theory and practice of his art for several years at Paris. Afterwards he confined himself to the disorders of pregnant and lying-in women, and was at the head of all the operators in this way. His *Observations sur la grossesse et sur l'accouchement des femmes, sur leurs maladies, et celles des enfans nouveaux*, 1694, in 4to, is reckoned an excellent work, and has been translated into several languages; German, Flemish, Italian, English: and the author himself translated it into Latin. It is illustrated with cuts. He published another piece or two, by way of supplement, on the same subject; and died at Paris in 1700.

MAURICE (St) commander of the Theban legion, was a Christian, together with the officers and soldiers of that legion, amounting to 6600 men.—This legion received its name from the city Thebes in Egypt, where it was raised. It was sent by Dioclesian to check the Bagaudae, who had excited some disturbances in Gaul. Maurice having carried his troops over the Alps, the emperor Maximian commanded him to employ his utmost exertions to extirpate Christianity. This proposal was received with horror both by the commander and by the soldiers.—The emperor, enraged at their opposition, commanded the legion to be decimated; and when they still declared that they would sooner die than do any thing prejudicial to the Christian faith, every tenth man of those who remained was put to death. Their perseverance excited the emperor to still greater cruelty; for when he saw that nothing could make them relinquish their religion, he commanded his troops to surround them, and cut them to pieces. Maurice, the commander of these Christian heroes, and Exuperus and Candidus, officers of the legion, who had chiefly incited the soldiers to this noble resistance, signalized themselves by their patience and their attachment to the doctrines of the Christian religion. They were massacred, it is believed, at Agaune, in Chablais, the 22d of September 286.—Notwithstanding many proofs which support this transaction, Dubordier, Hottinger, Moyle, Burnet, and Mosheim, are disposed to deny the fact. It is defended, on the other hand, by Hickee an English writer, and by Dom Joseph de Lisle a benedictine monk *de la congregation de Saint Vannes*, in a work of his, intitled, *Defense de la Verité du Martyre de la Legion Thebaine*, 1737. In defence of the same fact, the

Vol. X. Part II.

reader may consult *Historia di S. Mauricii*, by P. Rofignole a Jesuit, and the *Acta Sanctorum* for the month of September. The martyrdom of this legion, written by St Eucherius bishop of Lyons, was transmitted to posterity in a very imperfect manner by Surius. P. Chifflet a Jesuit, discovered, and gave to the public, an exact copy of this work. Don Ruinart maintains, that it has every mark of authenticity. St Maurice is the patron of a celebrated order in the kingdom of Sardinia's dominions, created by Emmanuel Philibert duke of Savoy, to reward military merit, and approved by Gregory XIII. in 1772. The commander of the Theban legion must not be confounded with another *St Maurice*, mentioned by Theodoret, who suffered martyrdom at Apamea, in Syria.

MAURICE (Mauritius Tiberius), was born at Arabisus in Cappadocia, A. D. 539. He was descended from an ancient and honourable Roman family.—After he had filled several offices in the court of Tiberius Constantine, he obtained the command of his armies against the Persians. His gallantry was so conspicuous, that the emperor gave him his daughter Constantina in marriage, and invested him with the purple the 13th August 582. The Persians still continued to make inroads on the Roman territories, and Maurice sent Philipppicus, his brother-in-law, against them. This general conducted the war with various success. At first he gained several splendid victories, but he did not continue to have a decided superiority. As there was great use for soldiers in these unfortunate times, the emperor issued a mandate in 592, forbidding any soldier to become a monk till he had accomplished the term of his military service. Maurice acquired much glory in restoring Chosroes II. king of Persia, to the throne, after he had been deposed by his subjects. The empire was in his reign harassed by the frequent inroads of the Arabian tribes. He purchased peace from them by granting them a pension nearly equal to 100,000 crowns; but these barbarians took frequent opportunities to renew the war. In different engagements the Romans destroyed 50,000, and took 17,000 prisoners. These were restored, on condition that the king of the Abars should return all the Roman captives in his dominions. Regardless of his promise, he demanded a ransom of 10,000 crowns. Maurice, full of indignation, refused the sum; and the barbarian, equally enraged, put the captives to the sword. While the emperor, to revenge this cruelty, was making preparations against the Abars, Phocas, who from the rank of a centurion had attained the highest military preferment, assumed the purple, and was declared emperor. He pursued Maurice to Chaledon, took him prisoner, and condemned him to die. The five sons of this unfortunate prince were massacred before his eyes; and Maurice, humbling himself under the hand of God, was heard to exclaim, *Thou art just, O Lord, and thy judgments are without partiality*. He was beheaded on the 26th November 602, in the 63d year of his age and 20th of his reign. Many writers have estimated the character of this prince by his misfortunes instead of his actions. They believed him guilty without evidence, and condemned him without reason. It cannot be denied, however, that he allowed Italy to be harassed, but he was a father to the rest of the empire. He re-

Maurice.

stored the military discipline, humbled the pride of his enemies, supported the Christian religion by his laws, and piety by his example. He loved the sciences, and was the patron of learned men.

MAURICE, elector of Saxony, son of Henry le Pieux, was born A. D. 1521. He was early remarkable for his courage, and during his whole life he was engaged in warlike pursuits. He served under the emperor Charles V. in the campaign of 1544 against France; and in the year following against the league of Smalkalde; with which, although a Protestant, he would have no manner of connection. The emperor, as a reward for his services, in the year 1547, made him elector of Saxony, having deprived his cousin John Frederick of that electorate. Ambition had led him to second the views of Charles, in the hope of being elector, and ambition again detached him from that prince. In 1551 he entered into a league against the emperor, together with the elector of Brandenburg, the Count Palatine, the duke of Wirtemberg, and many other princes. This league, encouraged by the young and enterprising Henry II. of France, was more dangerous than that of Smalkalde. The pretext for the association was the deliverance of the Landgrave of Hesse, whom the emperor kept prisoner. Maurice and the confederates marched, in 1552, to the desiles of Tirol, and put to flight the Imperial troops who guarded them. The emperor and his brother Ferdinand narrowly escaped, and fled from the conquerors in great disorder. Charles having retired into Passau, where he had collected an army, brought the princes of the league to terms of accommodation. By the famous peace of Passau, which was finally ratified the 12th of August 1552, the emperor granted an amnesty without exception to all those who had carried arms against him from the year 1546. The Protestants not only obtained the free exercise of their religion, but they were admitted into the imperial chamber, from which they had been excluded since the victory of Mulberg.—Maurice soon after united himself with the emperor against the Margrave of Brandenburg, who laid waste the German provinces. He engaged him in 1553, gained the battle of Sivershausen, and died of the wounds he had received in the engagement two days after. He was one of the greatest protectors of the Lutherans in Germany, and a prince equally brave and politic. After he had profited by the spoils of John Frederick, the chief of the Protestants, he became himself the leader of the party, and by these means maintained the balance of power against the emperor in Germany.

MAURICE de Nassau, prince of Orange, succeeded to the government of the Low Countries after the death of his father William, who was killed in 1584 by the fanatic Gerard. The young prince was then only eighteen years of age, but his courage and abilities were above his years. He was appointed captain general of the United Provinces, and he reared that edifice of liberty of which his father had laid the foundation. Breda submitted to him in 1590; Zutphen, Deventer, Hulst, Nimwegen, in 1591. He gained several important advantages in 1592, and in the year following he made himself master of Gertrudenburg. When he had performed these splendid services, he returned to the Low Countries by the way

Maurice.

of Zealand. His fleet was attacked by a dreadful tempest, in which he lost forty vessels, and he himself had very nearly perished. His death would have been considered by the Hollanders as a much greater calamity than the loss of their vessels. They watched over his safety with exceeding care. In 1594, one of his guards was accused of an intention to take away his life; and it was generally believed that he was bribed to this service by the enemies of the republic. He fell a sacrifice at Bruges, either to his own fanaticism or to the jealous anxiety of the friends of Maurice. The prince of Orange, increasing in reputation, defeated the troops of the archduke Albert in 1597, and drove the Spaniards entirely out of Holland. In 1600 he was obliged to raise the siege of Dunkirk; but he took ample vengeance on Albert, whom he again defeated in a pitched battle near Newport. Before the action, this great general sent back the ships which had brought his troops into Flanders: *My brethren* (said he to his army), *we must conquer the enemy or drink up the waters of the sea. Determine for yourselves; I have determined I shall either conquer by your bravery, or I shall never survive the disgrace of being conquered by men in every respect our inferiors.* This speech elevated the soldiers to the highest pitch of enthusiasm, and the victory was complete. Rhinberg, Grave, and Ecluse, cities in Flanders, submitted to the conqueror the following year. Maurice, however, not only laboured for the commonwealth, but also for himself. He coveted the sovereignty of Holland, and was opposed in the prosecution of his design by the pensioner Barneveldt. The zeal and activity of this wise republican cost him his life. He was an Arminian; and at this time Maurice defended Gomar against Arminius.—Taking advantage of the general odium under which the Arminians lay, he found means to get Barneveldt condemned in 1619. His death, wholly owing to the cruel ambition of the prince of Orange, made a deep impression on the minds of the Hollanders. The truce with Spain being expired, Spinola laid siege to Breda in 1624, and in six months, by the proper direction of his great talents, though with great slaughter of his troops, he took the place. The prince of Orange, unsuccessful in every attempt to raise the siege, died of vexation in 1625, aged 55 years, with the reputation of the greatest warrior of his time.—“The life of this Stadtholder (says the Abbé Raynal) was almost an uninterrupted series of battles, of sieges, and of victories. Of moderate abilities in every thing else, he shone conspicuous in his military capacity. His camp was the school of Europe, and those who received their military education in his armies augmented, perhaps, the glory of their master.—Like Montecuculi, he discovered inimitable skill in his marches and encampments; like Vauban, he possessed the talent of fortifying places, and of rendering them impregnable; like Eugene, the address of finding subsistence for great armies, in countries barren by nature, or ravaged by war; like Vendome, the happy talent of calling forth, in the moment they became necessary, greater exertions from his soldiers than could reasonably be expected; like Conde, that insupportable quickness of eye which decides the fortune of battles; like Charles XII. the art of rendering his troops almost invincible to cold, hunger, and fatigue; like Turenne, the secret of making war with the least possible

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Mauritania sible expence of human blood." The Chevalier Folard maintains, that Maurice was the greatest commander of infantry since the time of the Romans. He studied the military art of the ancients, and applied their rules with great exactness in the various occurrences of war. He not only took advantage of the inventions of others, but he enriched the science of war with several improvements. Telescopes were first used by him for a military purpose; and, besides a kind of gallery in conducting a siege, and the plan of blockading a strong place, which were of his invention, he greatly improved the whole art by his method of pushing an attack with great vigour, and of defending, for the greatest length of time, and in the best manner, a place besieged. In short, the many useful things which he practised or invented, placed him in the highest rank among men of a military character. On one occasion, a lady of quality asked him, *who was the first general of the age?* Spinola (replied he) *is the second.* It was his constant practice, during sleep, to have two guards placed by his bedside, not only to defend him in case of danger, but to awake him if there should be the least occasion. The war betwixt Spain and Holland was never carried on with greater keenness and animosity than during his administration.—The Grand Signior, hearing of the vast torrents of blood shed in this contest, thought that a great empire must depend on the decision. The object of so many battles was pointed out to him on a map, and he said coldly, *If it were my business, I would send my pioneers, and order them to cast this little corner of earth into the sea.* Maurice, like many great men, was impatient under contradiction, and too much devoted to women. He was succeeded by Frederic Henry his brother.

MAURITANIA, an ancient kingdom of Africa, bounded on the west by the Atlantic ocean, on the south by Getulia or Lybia Interior, and on the north by the Mediterranean, and comprehending the greater part of the kingdoms of Fez and Morocco.—Its ancient limits are not exactly mentioned by any historian; neither can they now be ascertained by any modern observations, these kingdoms being but little known to Europeans.

This country was originally inhabited by a people called *Mauri*, concerning the etymology of which name authors are not agreed. It is probable, however, that this country, or at least a great part of it, was first called *Phut*, since it appears from Pliny, Ptolemy, and St Jerom, that a river and territory not far from Mount Atlas went by that name. From the Jerusalem Targum it likewise appears, that part of the *Mauri* may be deemed the offspring of Lud the son of Misraim, since his descendants, mentioned Genesis x. are there called מורי, *Mauri*; or *Mauritani*. It is certain, that this region, as well as the others to the eastward of it, had many colonies planted in it by the Phenicians. Procopius tells us, that in his time two pillars of white stone were to be seen there, with the following inscription in the Phenician language and character, upon them: "We are the *Canaenites*, that fled from *Jehua* the son of Nun, that notorious robber." *Ibn Rachib*, or *Ibn Rachib*, an African writer cited by Leo, together with Evagrius and Nicephorus Callistus, assert the same thing.

The Mauritians, according to Ptolemy, were *Mauritania* divided into several cantons or tribes. The *Metagonites* were seated near the straits of Hercules, now those of Gibraltar. The *Sacefis*, or *Cocfis*, occupied the coast of the Iberian sea. Under these two petty nations the *Majices*, *Verrus*, and *Verbice* or *Verrice*, were settled. The *Sulfe*, or *Salmis*, were situated lower, towards the ocean; and, still more to the south, the *Volubilians*. The *Maurenfi* and *Hepiditani* possessed the eastern part of this country, which was terminated by the *Mulucha*. The *Angaucani* or *Jangaucuani*, *Nesiberes*, *Zagrenfi*, *Baniube*, and *Vacutæ*, extended themselves from the southern foot of Ptolemy's Atlas Minor to his Atlas Major. Pliny mentions the *Baniure*, whom Father Hardouin takes to be Ptolemy's *Baniubæ*; and *Mela* the *Atlantes*, whom he represents as possessed of the western parts of this district.

The earliest prince of Mauritania mentioned in history is Neptune; and next to him were Atlas and Antæus his two sons, both famous in the Grecian fables on account of their wars with Hercules. Antæus, in his contention with that hero, seems to have behaved with great bravery and resolution. Having received large reinforcements of Libyan troops, he cut off great numbers of Hercules's men. But that celebrated commander, having at last intercepted a strong body of Libyans sent to the relief of Antæus, gave him a total overthrow, wherein both he and the best part of his forces were put to the sword. This decisive action put Hercules in possession of Libya and Mauritania, and consequently of the riches of all these kingdoms. Hence came the fable, that Hercules, finding Antæus, a giant of an enormous size with whom he was engaged in single combat, to receive fresh strength as often as he touched his mother earth when thrown upon her, at last lifted him up in the air and squeezed him to death. Hence likewise may be deduced the fable intimating that Hercules took the globe from Atlas upon his own shoulders, overcame the dragon that guarded the orchards of the Hesperides, and made himself master of all the golden fruit there. Bochart thinks that the fable alluded chiefly to naval engagements, wherein Hercules, for the most part, was victorious; though Antæus from time to time received succours by sea. But at last Hercules, coming up with one of his squadrons which had a strong reinforcement on board, made himself master of it, and thus rendered Antæus incapable for the future of making head against him. The same author likewise insinuates, that the notion of Antæus's gigantic stature prevailing for so many centuries amongst the Tingitani, pointed out the size of the vessels of which his fleets and squadrons were composed. As for the golden apples so frequently mentioned by the old mythologists, they were the treasures that fell into Hercules's hands upon the defeat of Antæus; the Greeks giving the oriental word *malos*, *riches*, the signification affixed to their own term *malos*, *apples*.

With regard to the age in which Atlas and Antæus lived, the most probable supposition seems to be that of Sir Isaac Newton. According to that illustrious author, Ammon the father of Sefac was the first king of Libya, or that vast tract extending from the borders of Egypt to the Atlantic ocean; the conquest

Mauritania

quest of which country was effected by Sefac in his father's life-time. Neptune afterwards excited the Libyans to a rebellion against Sefac, and slew him; and then invaded Egypt under the command of Atlas or Antæus, the son of Neptune, Sefac's brother and admiral. Not long after, Hercules, the general of Thebais and Ethiopia for the gods or great men of Egypt, reduced a second time the whole continent of Libya, having overthrown and slain Antæus near a town in Thebais, from that event called *Antæa* or *Antæopolis*; this, we say, is the notion advanced by Sir Isaac Newton, who endeavours to prove, that the first reduction of Libya, by Sefac, happened a little above a thousand years before the birth of Christ, as the last, by Hercules, did some few years after. Now, though we do not pretend to adopt every particular circumstance of Sir Isaac Newton's system, yet we cannot forbear observing, that it appears undeniably plain from scripture, that neither the western extremity of Libya, nor even the other parts of that region, could possibly have been so well peopled before the time of David or Solomon, as to have sent a numerous army to invade Egypt. For Egypt and Phœnicia, from whence the greatest part of the ancestors of the Libyans came, and which were much nearer the place from whence the first dispersion of mankind was made, could not themselves have been greatly overstocked with inhabitants any considerable time before the reign of Saul. And that such an invasion happened in the reign of Neptune, or at least of his son Antæus, has been most fully evinced by this most excellent chronologer.

From the defeat of Antæus, nothing remarkable occurs in the history of Mauritania till the times of the Romans, who at last brought the whole kingdom under their jurisdiction; for which see the article *ROME*. With regard to the customs, &c. of this people, it would seem, from what Hyginus insinuates, that they fought only with clubs, till one Belus, the son of Neptune, as that author calls him, taught them the use of the sword. Sir Isaac Newton makes this Belus to have been the same person with Sesostris king of Egypt, who over-ran a great part of the then known world. 2. All persons of distinction in Mauritania went richly attired, wearing much gold and silver in their clothes. They took great pains in cleaning their teeth, and curled their hair in a curious and elegant manner. They combed their beards, which were very long, and always had their nails pared extremely close. When they walked out in any numbers, they never touched one another, for fear of disconcerting the curls into which their hair had been formed. 3. The Mauritanian infantry, in time of action, used shields made of elephants skins, being clad in those of lions, leopards, and bears, which they kept on both night and day. 4. The cavalry of this nation was armed with broad short lances, and carried targets or bucklers, made likewise of the skins of wild beasts. They used no saddles. Their horses were small and swift, had wooden collars about their necks, and were so much under the command of their riders, that they would follow them like dogs. The habit of these horsemen was not much different from that of the foot above-mentioned, they constantly wearing a large tunic of the skins of wild beasts. The Phutei,

of whom the Mauritians were a branch, were eminent for their shields, and the excellent use they made of them, as we learn from Homer, Xenophon, Herodotus, and scripture. Nay, Herodotus seems to intimate, that the shield and helmet came from them to the Greeks. 5. Notwithstanding the fertility of their soil, the poorer sort of the Mauritians never took care to manure the ground, being strangers to the art of husbandry; but roved about the country in a wild savage manner, like the ancient Scythians or Arabes Scenitæ. They had tents, or *mapalia*, so extremely small, that they could scarce breathe in them. Their food was corn, herbage, &c. which they frequently did eat green, without any manner of preparation; being destitute of wine, oil, and all the elegancies as well as many necessities of life. Their habit was the same both in summer and winter, consisting chiefly of an old tattered, though thick garment, and over it a coarse rough tunic; which answered probably to that of their neighbours the Numidians. Most of them lay every night upon the bare ground; though some of them strewed their garments thereon, not unlike the present African Kabyles and Arabs, who, according to Dr Shaw, use their hykes for a bed and covering in the night. 6. If the most approved reading of Horace may be admitted, the Mauritians shot poisoned arrows; which clearly intimates, that they had some skill in the art of preparing poisons, and were excellent dartmen. This last observation is countenanced by Herodian and Elian, who entirely come into it, affirming them to have been in such continual danger of being devoured by wild beasts, that they durst not stir out of their tents or *mapalia* without their darts. Such perpetual exercise must render them exceedingly skilful in hurling that weapon. 7. The Mauritians sacrificed human victims to their deities, as the Phœnicians, Carthaginians, &c. did.

The country people were extremely rude and barbarous; but those inhabiting cities must undoubtedly have had at least some smattering in the literature of the several nations they deduced their origin from. That the Mauritians had some knowledge in naval affairs, seems probable, not only from the intercourse they had with the Phœnicians and Carthaginians, as well as the situation of their country; but likewise from Orpheus, or Onomacritus, who asserts them to have made a settlement at the entrance into Colchis, to which place they came by sea. Magic, sorcery, divination, &c. they appear to have applied themselves to in very early times. Cicero and Pliny say, that Atlas was the inventor of astrology and the doctrine of the sphere, i. e. he first introduced them into Mauritania. This, according to Diodorus Siculus, gave rise to the fable of Atlas's bearing the heavens upon his shoulders. The same author relates, that Atlas instructed Hercules in the doctrine of the sphere and astrology, or rather astronomy, who afterwards brought those sciences into Greece.

MAURITIA, the GINKGO, or Maiden-hair tree: A genus of plants belonging to the natural order of Palmæ. The calyx of the male is monophyllous; the corolla monopetalous; with six stamina. It is a native of Japan, where it is also known by the names of *Ginan* and *Iyso*. It rises with a long, erect, thick and branched stem, to the size of a walnut-tree. The bark

Mauritania
Mauritia

Mauritius. bark is ash-coloured, the wood brittle and smooth, the pith soft and fungous. The leaves are large, expanded from a narrow bottom into the figure of a maiden-hair leaf, unequally parted, streaked, without fibres or nerves; both surfaces having the same appearance, and supported upon footstalks, which are compressed upon the upper surface, and extended into the substance of the leaf. From the uppermost footstalk the flowers in long catkins that are filled with the fertilizing powder; and to which succeeds the fruit, adhering to a thick fleshy pedicle, which proceeds from the bottom of the leaves. This fruit is either exactly or nearly round, and of the appearance and size of a damask plum. The substance surrounding the fruit is fleshy, juicy, white, very harsh, and adheres so firmly to the inclosed nut, as not to be separated from it, except by putrefaction. The nut, properly termed *Gineau*, resembles the pistachia nut, especially a Persian species named *bergjes pistai*; but is almost double in size, and of the figure of an apricot stone. The shell is somewhat white, woody, and brittle; and incloses a white loose kernel, having the sweetness of an almond, along with a degree of harshness. These kernels taken after dinner are said to promote digestion, and to give relief in surfeits; whence they never fail to make part of the desert in great feasts and anniversary entertainments.—Many of these plants have been reared by Mr James Gordon at his nursery near Mile-end. They seem to be very hardy, and thrive in this country in the open air.

MAURITIUS, or MAURICE, an island of Africa, about 400 miles east of Madagascar, lying in the latitude of 20 and 21 degrees south. In the beginning of the 16th century it was discovered by the Portuguese, who, knowing that Pliny and other ancient writers had mentioned the island of Cerne in these seas, took it for granted that this must be it; and accordingly we find it styled *Cerne* or *Sirre*, in their maps: but, notwithstanding this, they did not think fit to settle it; and indeed their force was so small, in comparison of the vast dominions they grasped, that it was very excusable. However, according to their laudable custom, they put some hogs, goats, and other cattle upon it, that in case any of their ships either going to the Indies, or returning to Portugal, should be obliged to touch there, they might meet with refreshments. The Dutch, in the second voyage they made to the East Indies under their admiral James Cornelius Vanneck, came together with five ships on the 15th of September 1568; anchored in a commodious port, to which they gave the name of *Warswick Haven*; and gave a very good account of the place in their journals. Captain Samuel Castleton, in the Pearl, an English East India ship, arrived there on the 27th of March 1612; and taking it to be an island undiscovered before, bestowed upon it the name of *England's Forest*, though others of his crew called it *Pearl-Island*, and in the account of their voyage, written by John Tatton the master of the ship, celebrated it as a place very convenient for shipping, either outward or homeward bound, to refresh at. This they sometimes accordingly did, and brought some cargoes of ebony and rich wood from thence, but without fixing any settlement.

At length, in 1638, the Dutch seized themselves

here; and it is highly remarkable, that at the very time they were employed in making their first settlement, the French sent a vessel to take possession of it, who found the Dutch before-hand with them, and refused the assistance of an English Indianman, wooding and watering in another port of the island, who very frankly offered it, to drive the Dutch from their half-settled pests. They continued for some time in quiet possession of the places they fortified in this island, to which they gave the name of *Mauritius*. But having engaged the French, who were settled on Madagascar, to steal 50 of the natives, and sell them for slaves, for the improvement of the Dutch settlements here, this proved the ruin of both colonies: for the negroes surprised and massacred the French in Madagascar; and the slaves in Mauritius fled into the centre of the island; from whence they so much and so incessantly molested those who had been formerly their masters, that they chose to quit a country where they could no longer remain in any tolerable degree of safety. The East India company, however, from motives of convenience, and a very imperfect notion of its value, disapproved this measure, and therefore ordered it to be resettled; which was accordingly done, and three forts erected at the principal havens. Things now went on somewhat better than they did before; but they were still very much disturbed by the revolted negroes in the heart of the isle, whom they could never subdue. One principal use that the company made of this place, was to send thither state-prisoners, who, as they were not men of the best morals, quickly corrupted the rest of the inhabitants, and rendered them such a race of outrageous smugglers, the situation of the place concurring with their bad dispositions, that, after various ineffectual attempts made to reform them, orders were at length given to abandon Mauritius a second time, which, after some delays, were put in execution in the year 1710.

Two years after this, the French took possession of it, and named it the *Isle de France*. This name has obtained among themselves, but the Europeans in general continue to call it Mauritius. It lies in S. Lat. 20. 15. E. Lon. 60 15. The inconveniences arising from the want of a port at the island of Bourbon, induced the French to take possession of Mauritius, it having two very good harbours, to fortify which no expence has been spared. That on the north-west is called *Port Louis*, that on the south-east side of the island is called *Port Bourbon*. The trade-wind from the south-east in these latitudes blows all the year round, excepting for a few days at the summer solstice, when it is interrupted by hard gales and hurricanes from the north. The ease with which this wind enables ships to enter the port of Bourbon, caused the French, when they first took possession of this spot, to esteem it the best port in the island; but experience pointing out to them, that the same wind often rendered the passage out of the harbour so difficult, that a ship was sometimes obliged to wait a considerable time before the weather admitted of her putting to sea, this harbour is in a great measure abandoned, and the principal town and seat of government is now fixed at port Louis, which is nearly in the middle of the north side of the island, and its entrance is through a channel formed by two shoals, which advance about two miles into the sea.

Mauritius,

the sea. When a ship arrives opposite to this channel, the south-east wind hinders her from entering the port under sail, and she must either warp in with cables or be towed in by boats. The necessity of this operation, joined to the extreme narrowness of the channel, which does not admit of two ships abreast of each other entering at the same time, is one of the best defences the harbour has against an attack by sea; for, from these obstacles, an enemy would find it a matter of the greatest difficulty to force the port; and in addition to this natural strength, they have built two forts and as many batteries, which are mounted with heavy cannon, and entirely command the approach to the harbour, should ships presume to force an entry under sail. This port is capable of containing 100 sail of ships, and is well provided with every requisite for repairing and even building of ships. This port has proved of the greatest advantage to France in the several wars which have been carried on between Great Britain and her; and has proved of great utility to the French East India company's commerce; for here their ships and crews were sure to meet with all necessary refreshment after a long voyage. The port of Bourbon is also fortified; and an army landed here would find it an extreme difficult task to pass the mountains to the different parts of the island. There are several places between the north-east extremity and port Louis where boats may land, but all these are defended by batteries; and the country behind them is a continued thicket: The rest of the coast is inaccessible. In the north-eastern quarter is a plain extending about 10 miles from east to west, and in some places five miles inland from the northern coast. All the rest of the island is full of high and steep mountains, lying so near to one another, and the intervals between them so narrow, that, instead of valleys, they rather resemble the beds of torrents; and these are choaked with huge fragments of rocks which have fallen from the steep sides of the impending mountains. On the summits of the mountains ice is frequently to be found, and they are covered with forests of ebony and other large trees. The ground they shade produces herbage, shrubs, and plants of various sorts, from the common grass to the strongest thorn, and that in such profusion, that they form a thicket so closely interwoven, that no progress can be made but by means of a hatchet. Notwithstanding these difficulties, plantations have been formed on these mountains, and very considerable progress has been made in the plains; but the productions, although mostly of the same kind, are not only in less quantity, but of an inferior quality to those produced at Bourbon island.

In a course of years, however, this settlement cost so much, and was considered in every light worth so little, that it had been more than once under deliberation, whether, after the example of the Dutch, they should not leave it again to its old negro inhabitants; which sooner or later in all likelihood would have been its fate, if, in 1735, the famous M. de la Bourdonnais had not been sent thither, with the title of *governor-general of the French islands*.

He found this life in the worst state possible. thinly inhabited by a set of lazy people, who equally hated

industry and peace, and who were continually flatter-Mauritius ing this man to his face, and belying him wherever and as far as they durst. He gave himself no trouble about this, having once found the means to make himself obeyed; he saw the vast importance of the island; he conceived that it might be settled to great advantage; and, without so much as expecting the thanks of those for whom he laboured, he began to execute this great design. His first step was to bring over black boys from Madagascar, whom he carefully trained up in good principles, and in continual exercise; by which he rendered them so good soldiers, that he very quickly obliged the Marones, or wild negroes, either to submit or to quit the island: he taught the planters to cultivate their lands to advantage; he, by an aqueduct, brought fresh water to the sea-side; and whereas they had not so much as a boat at his coming thither, he made a very fine dock, where he not only built sloops and larger vessels, but even a ship of the burden of 500 ton. However incredible it may seem, yet it is certainly fact, that in the space of five years he converted this country into a paradise, that had been a mere wilderness for 5000; and this in spite of the inhabitants, and of the company, who being originally prejudiced by them, behaved ill to him at his return. He soon made the cardinal de Fleury, however, sensible of the true state of things; and compelled the company to acknowledge, though they did not reward, his services. He afterwards returned into the Indies, and perfected the work he had begun, and to him it is owing that the life of France was rendered one of the finest and most important spots upon the globe. Here no coffee is raised; but by the indefatigable industry of M. de Bourdonnais, sugar, indigo, pepper, and cotton (which are not at Bourbon), came to be cultivated with success. Since the departure of that most excellent governor, the plantations have been neglected, and are fallen off; but if a proper spirit of activity was raised among the inhabitants, they might soon be made to resume their flourishing appearance. Mines of iron have been discovered in the mountains near the great plain, in the north-east part of the island; and these mountains affording in great abundance the necessary fuel, forges have been erected: but the iron produced is of a very inferior quality, it being brittle, and only fit for making cannon-balls and bomb-shells. Black cattle, sheep, and goats, are preserved with difficulty; the first generally die before they have been a year in the island, and this occasions frequent importations of them from Madagascar and other parts. Common domestic poultry breed in great plenty; and, with fish and turtle, furnish a great part of the food of the European inhabitants.

The approach to the island is extremely dangerous, it being surrounded with ledges of rocks, and many of them covered by the sea. The shore abounds with coral and shells. This island is said to contain 60 rivers: some are considerable streams, and most of them have their sources from lakes, of which there are several in the middle part of the island. The rivers afford plenty of various kinds of fish, particularly eels. These are of an enormous size, some having been found that were six feet long, and six inches in circumference, and so extremely voracious, that it is dangerous to
bathe

urua
centius
bathe in those parts of the river where they lie, as they will seize a man without fear, and have strength sufficient to keep him under water till he is drowned. Here is a great variety of birds, and bats as large as a young kitten : the inhabitants esteem them a delicate morsel. The air is both hot and moist, but not unwholesome. The place abounds with insects, which are very troublesome ; but there are no serpents. It has been discovered, that off Port Louis the south-east wind generally blows with least strength about sun-rise ; and it also happens, on four or five days, at intervals, in the course of a month, that early in the morning the wind ceases in the northern part of the island for an hour or two, when a breeze rises, although but faintly, from the north-west ; during which, a ship stationed at the entrance of the channel to avail herself of this breeze, may enter the harbour and attack the forts.

MAURUA, one of the Society-Islands in the South Sea. It is a small island, entirely surrounded with a ridge of rocks, and without any harbour for shipping. It is inhabited ; and its productions are the same with those of the neighbouring islands. A high round hill rises in the middle of it, which may be seen at the distance of 10 or 12 leagues.

MAUSOLEUM, a magnificent tomb or funeral monument. The word is derived from Mausolus king of Caria, to whom Artemisia his widow erected a most stately monument, esteemed one of the wonders of the world, and called it, from his own name, *Mausoleum*.

St MAWES, a town of Cornwall, in England, seated on the east side of Falmouth haven, in W. Long. 5. 26. N. Lat. 50. 30. Though but a hamlet of the parish of St Just, two miles off, without a minister, or either church, chapel, or meeting-house, it has sent members to parliament ever since 1562, who are returned by its mayor or portreeve. It consists but of one street, under a hill, and fronting the sea, and its inhabitants subsist purely by fishing. King Henry VIII. built a castle here, over against Pendennis, for the better security of Falmouth haven. It has a governor, a deputy, and two gunners, with a platform of guns. Here is a fair the Friday after St Luke's day.

MAXENTIUS (Marcus Aurelius Valerius), a son of the emperor Maximianus Hercules, was, by the voluntary abdication of Dioclesian, and of his father, raised to the empire, A. D. 306. He afterwards incited his father to re-assume his imperial authority ; and in a perfidious manner destroyed Severus, who had delivered himself into his hands, and relied upon his honour for the safety of his life. His victories and successes were impeded by Galerius Maximianus, who opposed him with a powerful force. The defeat and voluntary death of Galerius soon restored peace to Italy ; and Maxentius passed into Africa, where he rendered himself odious by his cruelty and oppression. He soon after returned to Rome, and was informed that Constantine was come to dethrone him. He gave his adversary battle near Rome, and, after he had lost the victory, he fled back to the city. The bridge over which he crossed the Tiber was in a decayed situation, and he fell into the river, and was drowned, A. D. 312. The cowardice and luxuries of Maxentius were as conspicuous as his cruelties. He

oppressed his subjects with heavy taxes, to gratify the cravings of his pleasures, or the avarice of his favourites. He was debauched in his manners, and neither virtue nor innocence were safe whenever he was inclined to voluptuous pursuits. His body was deformed, and unyielding. To visit a pleasure ground, or to exercise himself under a marble portico, or walk on a shady terrace, was to him a Herculean labour, which required the greatest exertions of strength and resolution.

MAXILLA, the JAW. See ANATOMY, n° 20 —26.

MAXIM, an established proposition or principle ; in which sense it denotes much the same with axiom.

MAXIMILIAN I. emperor of Germany, signalized himself against the French while he was king of the Romans, and after he was emperor entered into the army of Henry VIII. of England as a volunteer against that nation : he was a protector of learned men, and abolished an iniquitous tribunal, styled *Judicium oculum Westphalie* : he composed some poems, and the memoirs of his own life. He died in 1519, aged 60.

MAXIMUM, in mathematics, denotes the greatest quantity attainable in any given case.

If a quantity conceived to be generated by motion increases or decreases till it arrives at a certain magnitude or position, and then, on the contrary, grows greater or lesser, and it be required to determine the said magnitude or position, the question is called a *problem de maximis et minimis*.

MAXIMUS, a celebrated Cynic philosopher, and magician of Ephesus. He instructed the emperor Julian in magic ; and, according to the opinion of some historians, it was in the conversation and company of Maximus that the apostasy of Julian originated. The emperor not only visited the philosopher, but he even submitted his writings to his inspection and censure. Maximus refused to live in the court of Julian, and the emperor, not dissatisfied with the refusal, appointed him high pontiff in the province of Lydia, an office which he discharged with the greatest moderation and justice. When Julian went into the east, the philosopher promised him success, and even said that his conquests would be more numerous and extensive than those of the son of Philip. He persuaded his imperial pupil, that, according to the doctrine of Metempsychosis, his body was animated by the soul which once animated the hero whose greatness and victories he was going to eclipse. After the death of Julian, Maximus was almost sacrificed to the fury of the soldiers ; but the interposition of his friends saved his life, and he retired to Constantinople. He was soon after accused of magical practices, before the emperor Valens, and beheaded at Ephesus, A. D. 366. He wrote some philosophical and rhetorical treatises, some of which were dedicated to Julian. They are all now lost.

MAXIMUS of Tyre, a Platonic philosopher, went to Rome in 146, and acquired such reputation there, that the emperor Marcus Aurelius became his scholar, and gave him frequent proofs of his esteem. This philosopher is thought to have lived till the reign of the emperor Commodus. There are still extant 41 of his dissertations ; a good edition of which was printed by Daniel

Maxilla.
Maximus.

Maximus, Daniel Heinfius, in 1624, in Greek and Latin, with notes.

MAXIMUS MARIUS. See *MARIUS*.

MAXIMUS (St), an abbot and confessor of the 7th century, was of a noble family of Constantinople, and distinguished himself by his zeal against the Monothelites, for which he was thrown into prison, and died there on the 13th of August 1662. Hewrote a Commentary on the books attributed to Dionysius the Areopagite, and several other works, of which an edition has been published by father Combefis.

MAY, the fifth month in the year, reckoning from our first, or January; and the third, counting the year to begin with March, as the Romans anciently did. It was called *Maius* by Romulus, in respect to the senators and nobles of his city, who were named *maiores*; as the following month was called *Junius*, in honour of the youth of Rome, in *honorem juniorum*, who served him in the war; though some will have it to have been thus called from *Maius*, the mother of Mercury, to whom they offered sacrifice on the first day of it; and Papias derives it from *Medius: eo quod tunc terra maderet*. In this month the sun enters Gemini, and the plants of the earth in general begin to flower.—The month of May has ever been esteemed favourable to love; and yet the ancients, as well as many of the moderns, look on it as an unhappy month for marriage. The original reason may perhaps be referred to the feast of the Lemures, which was held in it. Ovid alludes to this in the fifth of his *Fasts*, when he says,

*Nec vidua tediis eadem, nec virginis apta
Tempora; quæ nuptiæ, non diuturna fuit;
Hæc quoque de causa, si te proverbia tangunt,
Mense malum Maio nubere vulgus ait.*

May-dew. See *Dew*.

May-duke, a species of cherry. See *PRUNUS*.

MAY (Isle of), a small island at the mouth of the Frith of Forth, in Scotland, about a mile and an half in circumference, and seven miles from the coast of Fife, almost opposite to the rock called the *Bass*. It formerly belonged to the priory of Pittenweem; and was dedicated to St Adrian, supposed to have been martyred in this place by the Danes; and hither, in times of Popish superstition, barren women used to come and worship at his shrine, in hopes of being cured of their sterility. Here is a tower and light-house built by Mr Cunningham of Barns, to whom king Charles I. granted the island in fee, with power to exact two-pence per ton from every ship that passes, for the maintenance of a light-house. In the middle of it there is a fresh-water spring, and a small lake. The soil produces pasturage for 100 sheep and 20 black cattle. On the west side the steep rocks render it inaccessible; but to the east there are four landing-places and good riding. It was here that the French Squadron, having the chevalier de St George on board, anchored in the year 1708, when the vigilance of Sir George Byng obliged him to relinquish his design, and bear away for Dunkirk. The shores all round the island abound with fish, and the cliffs with water-fowl.

MAY (Thomas), an eminent English poet and historian in the 17th century, was born of an ancient but decayed family in Suffex, educated at Cambridge, and

Nº 198.

afterwards removed to London, where he contracted a friendship with several eminent persons, and particularly with Endymion Porter, Esq; one of the gentlemen of the bed-chamber to king Charles I. While he resided at court, he wrote the five plays now extant under his name. In 1622, he published a translation of Virgil's *Georgics*, with annotations; and in 1633 a poem on king Edward III. and a translation of Lucan's *Pharsalia*, which poem he continued down to the death of Julius Cæsar, both in Latin and English verse. Upon the breaking out of the civil war he adhered to the parliament; and in 1647, he published, "The history of the parliament of England, which began November the third MDCXL. With a short and accessary view of some precedent years." In 1649, he published, *Historia parlamenti Angliæ Breviarium*, in three parts; which he afterwards translated into English. He wrote the History of Henry II. in English verse. He died in 1652. He went well to rest over-night, after a cheerful bottle as usual, and died in his sleep before morning; upon which his death was imputed to his tying his night-cap too close under his fat cheeks and chin, which caused his suffocation; but the facetious Andrew Marvel has written a poem of 100 lines, to make him a martyr of Bacchus, and die by the force of good wine. He was interred near Camden, in Westminster-Abbey; which caused Dr Fuller to say, that "if he were a biased and partial writer, yet he lieth buried near a good and true historian indeed." Soon after the restoration, his body, with those of several others, was dug up, and buried in a pit in St Margaret's church-yard; and his monument, which was erected by the appointment of Parliament, was taken down and thrown aside.

MAYER (Tobias), one of the greatest astronomers and mechanics this century has produced, was born at Mafpach, in the duchy of Wirtemberg 1723. He taught himself mathematics, and at the age of fourteen designed machines and instruments with the greatest dexterity and justness. These pursuits did not hinder him from cultivating the belles lettres. He acquired the Latin tongue, and wrote it with elegance. In 1750, the university of Gottingen chose him for their mathematical professor; and every year of his short life was thenceforward marked with some considerable discoveries in geometry and astronomy. He published several works in this way, which are all reckoned excellent; and some are inserted in the second volume of the "Memoirs of the university of Gottingen." His labours seem to have exhausted him; for he died worn out in 1762.

MAYERNE (Sir Theodore de), baron of Aulbone, was the son of Lewis de Mayerne, the celebrated author of *The general history of Spain*, and of the *Monarchie aristo-democratique*, dedicated to the states-general. He was born in 1573, and had for his god-father Theodore Beza. He studied physic at Montpellier, and was made physician in ordinary to Henry IV. who promised to do great things for him provided he would change his religion. James I. of England invited him over, and made him first physician to himself and his queen, in which office he served the whole royal family to the time of his death in

1655.

Mayhem 1655. His works were printed at London in 1702, and make a large folio, divided into two books; the first containing his *Consilia, Epistolæ, & Observationes*; the second his *Pharmacopœia varique medicamentorum formulæ*.

MAYHEM. See MAIM.

MAYNE (Jasper), an eminent English poet and divine in the 17th century, who was bred at Oxford, and entered into holy orders. While his majesty resided at Oxford, he was one of the divines appointed to preach before him. He published in 1647 a piece intitled, OXAOMAXIA, or, *The people's war examined according to the principles of reason and scripture, by Jasper Mayne*. In 1648 he was deprived of his studentship at Christ-church, and two livings he had; but was restored with the king, who made him his chaplain and archdeacon of Chichester; all which he held till he died. Dr Mayne was held in very high esteem both for his natural parts and his acquired accomplishments. He was an orthodox preacher, and a man of severe virtue and exemplary behaviour; yet of a ready and facetious wit, and a very singular turn of humour. From some stories that are related of him, he seems to have borne some degree of resemblance in his manner to the celebrated Dr Swift; but if he did not possess those very brilliant parts that distinguished the Dean, he probably was less subject to that capricious and those unaccountable whimsies which at times so greatly eclipsed the abilities of the latter. Yet there is one anecdote related of him, which, although it reflects no great honour on his memory, as it seems to carry some degree of cruelty with it, yet is it a strong mark of his resemblance to the Dean, and a proof that his propensity for drollery and joke did not quit him even in his latest moments. The story is this: The doctor had an old servant, who had lived with him some years, to whom he had bequeathed an old trunk, in which he told him he would find *something that would make him drink after his death*. The servant, full of expectation that his master, under this familiar expression, had left him somewhat that would be a reward for the assiduity of his past services, as soon as decency would permit flew to the trunk; when behold, to his great disappointment, the boasted legacy proved to be a red herring. The doctor, however, bequeathed many legacies by will to pious uses; particularly 50 pounds towards the rebuilding of St Paul's cathedral, and 200 pounds to be distributed to the poor of the parishes of Cassington and Pyrtown, near Watlington, of both which places he had been vicar. In his younger years he had an attachment to poetry; and wrote two plays, the latter of which may be seen in the tenth volume of Doddsley's collection, viz. 1. *Amorous war*, a tragedy. 2. *The city-match*, a comedy. He published a poem upon the naval victory by the duke of York over the Dutch, printed in 1665. He also translated into English from the Greek part of Lucian's Dialogues.

MAYNOOTH, or MANOOTH, a post town in the county of Kildare, and province of Leinster, in Ireland, near 12 miles from Dublin. Though not very large, it is regularly laid out, and consists of good houses. Here is a charter-school, which was opened 27th July 1759.

Vol. X. Part II.

MAYNWARING (Arthur), an eminent political writer in the beginning of the 18th century, staid several years at Oxford, and then went to Cheshire, where he lived some time with his uncle Mr Francis Cholmondeley, a very honest gentleman, but extremely averse to the government of king William III. to whom he refused the oaths. Here he prosecuted his studies in polite literature with great vigour; and coming up to London, applied to the study of the law. He was hitherto very zealous in anti-revolutional principles, and wrote several pieces in favour of king James II.; but upon being introduced to the duke of Somerset and the earls of Dorset and Burlington, began to entertain very different notions in politics. His father left him an estate of near 800 l. a-year, but so incumbered, that the interest money amounted to almost as much as the revenue. Upon the conclusion of the peace he went to Paris, where he became acquainted with Mr Boileau. After his return he was made one of the commissioners of the customs, in which post he distinguished himself by his skill and industry. He was a member of the kit-cat-club, and was looked upon as one of the chief supports of it by his pleasantry and wit. In the beginning of queen Anne's reign, the lord treasurer Godolphin engaged Mr Done to quit the office of auditor of the imposts, and made Maynwarine a present of a patent for that office worth about 2000 l. a-year in a time of business. He had a considerable share in the Medley, and was author of several other pieces. The Examiner, his antagonist in politics, allowed that he wrote with tolerable spirit, and in a masterly style. Sir Richard Steele dedicated the first volume of the Tatler to him.

MAYO, one of the Cape de Verd islands, lying in the Atlantic ocean, near 300 miles from Cape Verd in Africa, about 17 miles in circumference. The soil in general is very barren, and water scarce; however, they have some corn, yams, potatoes, and plantains, with plenty of beeves, goats, and asses. What trees there are, grow on the sides of the hills, and they have some figs and water-melons. The sea round about the island abounds with fish. The chief commodity is salt, with which many English ships are loaded in the summer-time. The principal town is Pinosa, inhabited by negroes, who speak the Portuguese language, and are stout, lully, and fleshy. They are not above 200 in number, and many of them go quite naked. W. Long, 21. 25. N. Lat. 15. 5.

MAYO, a county of Ireland, in the province of Connaught, having Sligo and the sea on the north, Roscommon on the south, Leitrim and Roscommon on the east, and the Atlantic ocean on the west. It contains 724,640 Irish plantation acres, 73 parishes, 9 baronies, and one borough; and sends four members to parliament. It gives title of earl to the family of Bourke. This county takes its name from an ancient city, built in 664; the ruins of the cathedral, and some traces of the stone walls which encompassed the city, yet remain on the plains of Mayo. It was a university, founded for the education of such of the Saxon youths as were converted to the Christian faith: it was situated a little to the south of Lough Conn; and is to this day frequently called *Mayo of the Saxons*, being celebrated for giving education to Alfred the great king of England. As this town has

Maynwaring, Mayo.

Mayor.

gone to decay, Balinrobe is reckoned the chief town. The country by the sea is mountainous; but inland has good pastures, lakes, and rivers. It is about 57 miles long, and 48 broad. Cattlebar is the assizes town.— Mayo was formerly a bishop's see, which is now united to Tuam.

MAYOR, the chief magistrate of a city or town, chosen annually out of the aldermen. The word, anciently wrote *mayr*, comes from the British *miret*, i. e. *custodire*, or from the old English *maier*, viz. *potestas*, and not from the Latin *major*. King Richard I. in 1189, changed the bailiff of London into a mayor, and from that example king John made the bailiff of King's Lynn a mayor anno 1204: Though the famous city of Norfolk obtained not this title for its chief magistrate till the seventh year of king Henry V. anno 1419; since which there are few towns of note but have had a mayor appointed for government.

Mayors of corporations are justices of peace *pro tempore*, and they are mentioned in several statutes; but no person shall bear any office of magistracy concerning the government of any town, corporation, &c. who hath not received the sacrament according to the church of England within one year before his election, and who shall not take the oaths of supremacy, &c.

If any person intrudes into the office of mayor, a *quo warranto* lies against him, upon which he shall not only be ousted, but fined. And no mayor, or person holding an annual office in a corporation for one year, is to be elected into the same office for the next; in this case, persons obstructing the choice of a successor are subject to 100 l. penalty. Where the mayor of a corporation is not chosen on the day appointed by charter, the next office in place shall the day after hold a court and elect one; and if there be a default or omission that way, the electors may be compelled to choose a mayor, by a writ of *mandamus* out of the king's bench. Mayors, or other magistrates of a corporation, who shall voluntarily absent themselves on the day of election, are liable to be imprisoned, and disqualified from holding any office in the corporation.

MAYOR'S COURTS. To the lord mayor and city of London belong several courts of judicature. The highest and most ancient is that called the *hustings*, designed to secure the laws, rights, franchises, and customs of the city. The second is a court of *request*, or of *conscience*; of which before. The third is the court of the lord mayor and aldermen, where also the sheriffs sit: to which may be added two courts of sheriffs and the court of the city orphans, whereof the lord mayor and aldermen have the custody. Also the court of common council, which is a court or assembly, wherein are made all by-laws which bind the citizens of London. It consists, like the parliament, of two houses: an upper, consisting of the lord mayor and aldermen; and a lower, of a number of common council men, chose by the several wards, as representatives of the body of the citizens. In the court of common council are made laws for the advancement of trade, and committees yearly appointed, &c. But acts made by them are to have the assent of the lord mayor and aldermen, by stat. 11 Geo. I. Also the chamberlain's

Maga

Mazarine.

court, where every thing relating to the rents and revenues of the city, as also the affairs of servants, &c. are transacted. Lastly, to the lord mayor belong the courts of coroner and of escheator; another court for the conservation of the river Thames; another of gaol-delivery, held usually eight times a year, at the Old Bailey, for the trial of criminals, whereof the lord mayor is himself the chief judge. There are other courts called *wardmotes* or meetings of the wards; and courts of halmote or assemblies of the several guilds and fraternities.

MAZA, among the Athenians, was a sort of cake made of flour boiled with water and oil, and set, as the common fare, before such as were entertained at the public expence in the common hall or *prytaneum*.

MAZAGAN, a strong place of Africa, in the kingdom of Morocco, and on the frontiers of the province of Duguela. It was fortified by the Portuguese, and besieged by the king of Morocco with 200,000 men in 1562, but to no purpose. It is situated near the sea. W. Long. 7. 45. N. Lat. 33. 5.

MAZARA, an ancient town of Sicily, and capital of a considerable valley of the same name, which is very fertile, and watered with several rivers. The town is a bishop's see, and has a good harbour; is seated on the sea coast, in E. Long. 12. 39. N. Lat. 37. 42.

MAZARINE (Julius), a famous cardinal and prime minister of France, was born at Piscina in the province of Abruzzo, in Naples, in 1602. After having finished his studies in Italy and Spain, he entered into the service of cardinal Sachetti, and became well skilled in politics, and in the interests of the princes at war in Italy; by which means he was enabled to bring affairs to an accommodation, and the peace of Queiras was shortly concluded. Cardinal Richelieu being taken with his conduct, did from thenceforward highly esteem him; as did also cardinal Antonio, and Louis XIII. who procured him a cardinal's hat in 1641. Richelieu made him one of the executors of his will; and during the minority of Louis XIV. he had the charge of affairs. At last he became the envy of the nobility, which occasioned a civil war; whereupon Mazarine was forced to retire, a price was set on his head, and his library sold. Notwithstanding he afterwards returned to the court in more glory than ever; concluded a peace with Spain, and a marriage treaty betwixt the king and the infant. This treaty of peace passes for the masterpiece of cardinal de Mazarine's politics, and procured him the French king's most intimate confidence: but at last his continual application to business threw him into a disease, of which he died at Vincennes in 1661.—Cardinal Mazarine was of a mild and affable temper. One of his greatest talents was his knowing mankind, and his being able to adapt himself, and to assume a character conformable to the circumstances of affairs. He possessed at one and the same time the bishopric of Metz, and the abbey of St Arnaud, St Clement, and St Vincent, in the same city; that of St Dennis, Clugny, and Victor, of Marseilles; of St Michael at Soissons, and a great number of others. He founded Mazarine-college at Paris, which is also called the *college of the four nations*. There has been published a collection of his letters, the most copious

Mazzuoli, copious edition of which is that of 1745, in 2 vols duodecimo.

MAZZUOLI. See PARMIGIANO.

MEAD, a wholesome, agreeable liquor, prepared of honey and water.

One of the best methods of preparing mead is as follows : Into twelve gallons of water dip the whites of six eggs ; mixing these well together, and to the mixture adding twenty pounds of honey. Let the liquor boil an hour, and when boiled add cinnamon, ginger, cloves, mace, and a rosemary. As soon as it is cold, put a spoonful of yest to it, and tun it up, keeping the vessel filled as it works ; when it has done working, stop it up close ; and, when fine, bottle it off for use.

Thorley says, that mead not inferior to the best of foreign wines may be made in the following manner : Put three pounds of the finest honey to one gallon of water, and two lemon peels to each gallon ; boil it half an hour, well scummed ; then put in, while boiling, lemon peel : work it with yest ; then put it in your vessel with the peel, to stand five or six months, and bottle it off for use. If it is to be kept for several years, put four pounds to a gallon of water.

The author of the Dictionary of Chemistry directs to choose the whitest, purest, and best-tasted honey, and to put it into a kettle with more than its weight of water : a part of this liquor must be evaporated by boiling, and the liquor scummed, till its consistence is such, that a fresh egg shall be supported on its surface without sinking more than half its thickness into the liquor ; then the liquor is to be strained, and poured through a funnel into a barrel ; this barrel, which ought to be nearly full, must be exposed to a heat as equable as possible, from 20 to 27 or 28 degrees of Mr Reaumur's thermometer, taking care that the bung-hole be slightly covered, but not closed. The phenomena of the spirituous fermentation will appear in this liquor, and will subsist during two or three months, according to the degree of heat ; after which they will diminish and cease. During this fermentation, the barrel must be filled up occasionally with more of the same kind of liquor of honey, some of which ought to be kept a part, on purpose to replace the liquor which flows out of the barrel in froth. When the fermentation ceases, and the liquor has become very vinous, the barrel is then to be put into a cellar, and well closed ; a year afterwards the mead will be fit to be put into bottles.

Mead is a liquor of very ancient use in Britain. See the article FEAST, p. 182, col. i.

MEAD (Dr Richard), a celebrated English physician, was born at Stepney near London, where his father, the Reverend Mr Matthew Mead, had been one of the two ministers of that parish ; but in 1662 was ejected for nonconformity, but continued to preach at Stepney till his death. As Mr Mead had a handsome fortune, he bestowed a liberal education upon 13 children, of whom Richard was the eleventh ; and for that purpose kept a private tutor in his house, who taught him the Latin tongue. At 16 years of age Richard was sent to Utrecht, where he studied three years under the famous Grevius ; and then choosing the profession of physic, he went to Leyden, where he attended the lectures of the famous Pitcairn

on the theory and practice of medicine, and Hermon's botanical courses. Having also spent three years in these studies, he went with his brother and two other gentlemen to visit Italy, and at Padua took his degree of doctor of philosophy and physic in 1695. Afterwards he spent some time at Naples and at Rome ; and returning home the next year, settled at Stepney, where he married, and practised physic, with a success that laid the foundation of his future greatness.

In 1703, Dr Mead having communicated to the Royal Society an analysis of Dr Bonomo's discoveries relating to the cutaneous worms that generate the itch, which they inserted in the Philosophical Transactions ; this, with his account of poisons, procured him a place in the Royal Society, of which Sir Isaac Newton was then president. The same year he was elected physician of St Thomas's hospital, and was also employed by the surgeons to read anatomical lectures in their hall, which obliged him to remove into the city. In 1707 his Paduan diploma for doctor of physic was confirmed by the university of Oxford ; and being patronized by Dr Radcliffe, on the death of that famous physician he succeeded him in his house at Bloomsbury-square, and in the greatest part of his business. In 1727 he was made physician to King George II. whom he had also served in that capacity while he was prince of Wales ; and he had afterwards the pleasure of seeing his two sons-in-law, Dr Nichols and Dr Wilmot, his coadjutors in that eminent station.

Dr Mead was not more to be admired for the qualities of the head than he was to be loved for those of his heart. Though he was himself a hearty whig, yet, uninfluenced by party-principles, he was a friend to all men of merit, by whatever denomination they might happen to be distinguished. Thus he was intimate with Garth, with Arbuthnot, and with Freind ; and long kept up a constant correspondence with the great Boerhaave, who had been his fellow-student at Leyden ; they communicated to each other their observations and projects, and never loved each other the less for being of different sentiments. In the mean time, intent as Dr Mead was on the duties of his profession, he had a greatness of mind that extended itself to all kinds of literature, which he spared neither pains nor money to promote. He caused the beautiful and splendid edition of Thuanus's history to be published in 1713, in seven volumes folio : and by his interpolation and assiduity, Mr Suttan's invention of drawing foul air from ships and other close places was carried into execution, and all the ships in his majesty's navy provided with this useful machine. Nothing pleased him more than to call hidden talents into light ; to give encouragement to the greatest projects, and to see them executed under his own eye. During almost half a century he was at the head of his business, which brought him one year above seven thousand pounds, and for several years between five and six thousand : yet clergymen, and in general all men of learning, were welcome to his advice. His library consisted of 10,000 volumes, of which his Latin, Greek, and oriental manuscripts, made no inconsiderable part. He had a gallery for his pictures and antiquities, which cost him great sums. His reputation, not only as a

Meadow. physician, but as a scholar, was so universally established, that he corresponded with all the principal literati in Europe: even the king of Naples sent to desire a complete collection of his works; and in return made him a present of the two first volumes of Signior Bajardi, which may be considered as an introduction to the collection of the antiquities of Herculaneum. At the same time that prince invited him to his palace, that he might have an opportunity of showing him those valuable monuments of antiquity; and nothing but his great age prevented his undertaking a journey so suited to his taste. No foreigner of learning ever came to London without being introduced to Dr Mead; and on these occasions his table was always open, and the magnificence of princes was united with the pleasures of philosophers. It was principally to him that the several counties of England and our colonies abroad applied for the choice of their physicians, and he was likewise consulted by foreign physicians from Russia, Prussia, Denmark, &c. He wrote, besides the above works, 1. *A Treatise on the Scurvy*. 2. *De variolis et morbillis dissertatio*. 3. *Medica sacra: sive de Morbis insignioribus, qui in Bibliis memorantur, Commentarius*. 4. *Monita et Præcepta medica*. 5. *A Discourse concerning peccilential contagion, and the methods to be used to prevent it*. The works he wrote and published in Latin were translated into English, under the doctor's inspection, by Thomas Stack, M. D. and F. R. S. This great physician, naturalist, and antiquarian, died on the 16th of February 1754.

MEADOW, in its general signification, means pasture or grass-land, annually mown for hay: but it is more particularly applied to lands that are so low as to be too moist for cattle to graze upon them in winter without spoiling the sward.

An improvement in agriculture by watering of meadows has of late come into much use, and been found of very considerable importance. In the Monthly Review for October 1788, the editors acknowledge the favour of a correspondent, who informed them, that watering of meadows was practised during the reigns of Queen Elizabeth and James I. A book was written upon the subject by one Rowland Vaughan, who seems to have been the inventor of this art, and who practised it on a very extensive plan in the Golden Valley in Herefordshire. Till this note to the Reviewers appeared, the inhabitants of a village called South-Cerney in Gloucestershire had assumed the honour of the invention to themselves, as we are informed in a treatise upon the subject by the reverend Mr Wright curate of the place. According to a received tradition in that village, watering of meadows has been practised there for about a century, and was introduced by one *Wellavise*, a wealthy farmer in South-Cerney. His first experiment was by cutting a large ditch in the middle of his ground, from which he threw the water over some parts, and allowed it to stagnate in others: but finding this not to answer his expectations, he improved his method by cutting drains and filling up the hollows; and thus he succeeded so well, that his neighbours, who at first had called him a madman, soon changed their opinion, and began to imitate his example.

The advantages which attend the watering of meadows are many and great; not only as excellent crops

of grass are thus raised, but as they appear so early, Meadow. that they are of infinite service to the farmers for food to their cattle in the spring before the natural grass rises. By watering we have plenty of grass in the beginning of March, and even earlier when the season is mild. The good effects of this kind of grass upon all sorts of cattle are likewise astonishing, especially upon such as have been hardly wintered; and Mr Wright informs us, that the farmers in his neighbourhood, by means of watering their lands, are enabled to begin the making of cheese at least a month sooner than their neighbours who have not the same advantage. Grass raised by watering is found to be admirable for the nurture of lambs; not only those designed for fattening, but such as are to be kept for store: For if lambs when very young are stopped and stinted in their growth, they not only become contracted for life themselves, but in some measure communicate the same diminutive size to their young. The best remedy for preventing this evil is the spring feed from watered meadows; and Mr Wright is of opinion, that if the young of all kinds of farmer's stock were immediately encouraged by plenty of food, and kept continually in a growing state, there would in a few years be a notable change both in the size and shape of cattle in general. Such indeed is the forwardness of grass from watered meadows, that the feed between March and May is worth a guinea per acre; and in June an acre will yield two tons of hay, and the after-math is always worth twenty shillings; and nearly the same quantity is constantly obtained whether the summer be dry or wet. In dry summers also, such farmers as water their meadows have an opportunity of selling their hay almost at any price to their neighbours.

Land treated in this manner is continually improving in quality, even though it be mown every year: the herbage, if coarse at first, becomes finer; the soil, if swampy, becomes found; the depth of its mould is augmented, and its quality meliorated every year. To these advantages (says Mr Boswell in his treatise upon this subject) another may be addressed to the gentleman who wishes to improve his estate, and whose benevolent heart prompts him to extend a charitable hand to the relief of the indolent poor, and not to idleness and vice: almost the whole of the expence in this mode of cultivation is the actual manual labour of a class of people who have no genius to employ their bodily strength otherwise for their own support and that of their families; consequently, when viewed in this light, the expence can be but comparatively small, the improvement great and valuable.

As a proof of the above doctrine, Mr Wright adduces an instance of one year's produce of a meadow in his neighbourhood. It had been watered longer of than the eldest person in the neighbourhood could remember; but was by no means the best meadow upon the stream, nor was the preceding winter favourable for watering. It contains six acres and an half. The spring-feed was let for seven guineas, and supported near 200 sheep from the 1st of March till the beginning of May: the hay being sold for 30 guineas, and the after-math for six. Another and still more remarkable proof of the efficacy of watering, is, that two of the most skillful watermen of that place were sent to lay out a meadow of seven acres, the whole crop of which was that year sold for

Meadow. two pounds. Though it was thought by many impossible to throw the water over it, yet the skill of the workmen soon overcame all difficulties; and ever since that time the meadow has been let at the rent of three pounds per acre. From manifold experience, our author informs us, that the people in that part of the country are so much attached to the practice of watering, that they never suffer the smallest spring or rivulet to be unemployed. Even those temporary floods occasioned by sudden showers are received into proper ditches, and spread equally over the lands until its fertilizing property be totally exhausted. "Necessity (says he) indeed compels us to make the most of every drop; for we have near 300 acres in this parish, that must all, if possible, be watered; and the stream that affords the water seldom exceeds five yards in breadth and one in depth: therefore we may say, that a scarcity of water is almost as much dreaded by us as by the celebrated inhabitants of the banks of the Nile."

5 The practice of watering ought to be more generally extended. Considering the great advantages to be derived from the practice of watering meadows, and the many undoubted testimonies in its favour, Mr Wright expresses his surprise that it has not come into more general use, as there is not a stream of water upon which a mill can be erected but what may be made subservient to the enriching of some land, perhaps to a great quantity. "I am confident (says he), that there are in each county of England and Wales 2000 acres upon an average which might be thus treated, and every acre increased at least one pound in annual value. The general adoption therefore of watering is capable of being made a national advantage of more than 100,000*l.* per annum, besides the great improvement of other land arising from the produce of the meadows and the employment of the industrious poor. Such an improvement, one would think, is not unworthy of public notice; but if I had doubled the sum, I believe I should not have exceeded the truth, though I might have gone beyond the bounds of general credibility. In this one parish where I reside there are about 300 acres now watered; and it may be easily proved that the proprietors of the land reap from thence 1000*l.* yearly profit."

In Mr Boswell's treatise upon this subject, published in 1790, the author complains of the neglect of the practice of improving the wet, boggy, and rushy lands, which lie at the banks of rivers, and might be meliorated at a very small expence, when much larger sums are expended in the improvement of barren uplands and large tracts of heath in various parts of the kingdom; and he complains likewise of the little information that is to be had in books concerning the method of performing this operation. The only author from whom he acknowledges to have received any information is Blyth; and even his method of watering is very different from that practised in modern times; for which reason he proposes to furnish an original treatise upon the subject; and of this we shall now give the substance.

6 The first thing to be considered is, what lands are capable of being watered. These, according to Mr Boswell, are all such as lie low, near the banks of rivulets and springs, especially where the water-course is higher than the lands, and kept within its bounds by banks. If the rivulet has a quick descent, the im-

provement by watering will be very great, and the expences moderate. On level lands the water runs but slowly, which is also the case with large rivers; and therefore only a small quantity of ground can be overflowed by them in comparison of what can be done in other cases: but the water of large rivers is generally possessed of more fertilizing properties than that of rivulets. In many cases, however, the rivers are navigable, or have mills upon them; both of which are strong objections to the perfect improvement of lands adjacent to them. From these considerations, our author concludes, that the watering of lands may be performed in the best and least expensive manner by small rivulets and springs.

There are three kinds of soils commonly found near the banks of rivers and rivulets, the melioration of which may be attempted by watering. 1. A gravelly or found warm firm soil, or a mixture of the two together. This receives an almost instantaneous improvement; and the faster the water runs over it the better. 2. Boggy, miry, and rushy soils, which are always found by the banks of rivers where the land is nearly level. These also are greatly improved by watering; perhaps equally so with those already described, if we compare the value of both in their unimproved state, this kind of ground being scarce worth any thing in its unimproved state. By proper watering, however, it may be made to produce large crops of hay, by which horned cattle may be kept through the winter and greatly forwarded; though, in its uncultivated state, it would scarce produce any thing to maintain stock in the winter, and very little even in summer. Much more skill, as well as expence, however, is requisite to bring this kind of land into culture than the former. 3. The soils most difficult to be improved are strong, wet, and clay soils; and this difficulty is occasioned both by their being commonly on a dead level, which will not admit of the water running over them; and by their tenacity, which will not admit of draining. Even when the utmost care is taken, unless a strong body of water is thrown over them, and that from a river the water of which has a very fertilizing property, little advantage will be gained; but wherever such advantages can be had in the winter, and a warm spring succeeds, these lands will produce very large crops of grass.

7 The advantage of using springs and rivulets for watering instead of large rivers is, that the expence of raising waters across them will not be great; nor are they liable to the other objections which attend the use of large rivers. When they run through a cultivated country also, the land floods occasioned by violent rains frequently bring with them such quantities of manure as contribute greatly to fertilize the lands, and which are totally lost where the practice of watering is not in use.

Springs may be useful to the coarse lands that lie near them, provided the water can be had in sufficient quantity to overflow the lands. "By springs (says our author), are not here meant such as rise out of poor heath or boggy lands (for the water issuing from them is generally so small in quantity, and always so very lean and hungry in quality, that little if any advantage can be derived from it); but rather the head of rivulets and brooks rising out of a chalky and gravelly

Meadow.

5 The practice of watering ought to be more generally extended.

6 Land capable of being watered.

7 Watering instead of large rivers is, that the expence of raising waters across them will not be great; nor are they liable to the other objections which attend the use of large rivers.

Meadow. gravelly found firm soil, in a cultivated country. These are invaluable; and every possible advantage should be taken to improve the ground near them. The author knows a considerable tract of meadow-land under this predicament; and one meadow in particular that is watered by springs issuing immediately out of such a soil, without any advantage from great towns, &c. being situated but a small distance below the head of the rivulet, and the rivulet itself is fed all the way by springs rising out of its bed as clear as crystal. The soil of the meadow is a good loam some inches deep, upon a fine springy gravel. Whether it is from the heat of the springs, or whether the friction by the water running over the soil raises a certain degree of warmth favourable to vegetation, or from whatever cause it arises, the fecundity of this water is beyond conception; for when the meadow has been properly watered and well drained, in a warm spring, the grass has been frequently cut for hay within five weeks from the time the stock was taken out of it, having eat it bare to the earth: almost every year it is cut in six weeks, and the produce from one to three waggon loads to an acre. In land thus situated, in the mornings and evenings in the months of April, May, and June, the whole meadow will appear like a large furnace; so considerable is the steam or vapour which arises from the warmth of the springs acted upon by the sun-beams: and although the water is so exceeding clear, yet upon its being thrown over the land only a few days in warm weather, by dribbling through the grass, so thick a scum will arise and adhere to the blades of the grass, as will be equal to a considerable quantity of manure spread over the land, and (it may be presumed from the good effects) still more enriching.

"It is inconceivable what 24 hours water properly conveyed over the lands will do in such a season: a beautiful verdure will arise in a few days where a parched rusty soil could only be seen; and one acre will then be found to maintain more stock than ten could do before."

8
Explanation of the terms used in water-works.

Mr Boswell next proceeds to an explanation of the terms used in this art; of the instruments necessary to perform it; and of the principles on which it is founded. The terms used are:

1. A **WARE.** This is an erection across a brook, rivulet, or river, frequently constructed of timber, but more commonly of bricks or stones and timber, with openings to let the water pass, from two to ten in number according to the breadth of the stream; the height being always equal to the depth of the stream compared with the adjacent land. The use of this is occasionally to stop the current, and to turn it aside into the adjacent lands.

2. A **SLUICE** is constructed in the same manner as a ware; only that it has but a single passage for the water, and is put across small streams for the same purposes as a ware.

3. A **TRUNK** is designed to answer the same purposes as a sluice; but being placed across such streams as either cattle or teams are to pass over, or where it is necessary to carry a small stream at right angles to a large one to water some lands lower down, is for these reasons made of timber, and is of a square figure.

The length and breadth are various as circumstances determine.

4. A **CARRIAGE** is made of timber or of brick. If of timber, oak is the best; if of brick, an arch ought to be thrown over the stream that runs under it, and the sides bricked up: But when made of timber, which is the most common material, it is constructed with a bottom and sides as wide and high as the main in which it lies. It must be made very strong, close, and well-jointed. Its use is to convey the water in one main over another, which runs at right angles to it; the depth and breadth are the same with those of the main to which it belongs; and the length is determined by that which it crosses. The carriage is the most expensive instrument belonging to watering.

5. A **DRAIN-SLUICE, or Drain-Trunk**, is always placed in the lower part of some main, as near to the head as a drain can be found; that is, situated low enough to draw the main, &c. It is made of timber, of a square figure like a trunk, only much smaller. It is placed with its mouth at the bottom of the main, and let down into the bank; and from its other end a drain is cut to communicate with some trench drain that is nearest. The dimensions are various, and determined by circumstances. The use of it is, when the water is turned some other way, to convey the leaking water that oozes through the hatches, &c. into the drain, that otherwise would run down into the tails of those trenches which lie lowest, and there poach and rot the ground, and probably contribute not a little to the making it more unfound for sheep. This operation is of the utmost consequence in watering; for if the water be not thoroughly drained off the land, the soil is rotted; and when the hay comes to be removed, the wheels of the carriages sink, the horses are mired, and the whole load sometimes sticks fast for hours together. On the other hand, when the drain-trunks are properly placed, the ground becomes firm and dry, and the hay is speedily and easily removed.

7. **HATCHES** are best made of oak, elm, or deal; the use of them is to fit the openings of wares, trunks, or sluices; and to keep back the water when necessary, from passing one way, to turn it another. They ought to be made to fit as close as possible. When hatches belong to wares that are erected across large streams, or where the streams swell quickly with heavy rains, when the hatches are in their places to water the meadows; they are sometimes made so, that a foot or more of the upper part can be taken off, so that vent may be given to the superfluous water, and yet enough retained for the purpose of watering the meadows. In this case, they are called *flood-hatches*; but Mr Boswell entirely disapproves of this construction, and recommends them to be made entire, though they should be ever so heavy, and require the assistance of a lever to raise them up. For when the water is very high, and the hatches are suddenly drawn up, the water falls with great force upon the bed of the ware, and in time greatly injures it: but when the whole hatch is drawn up a little way, the water runs off at the bottom, and does no injury.

8. A **HEAD-MAIN**, is a ditch drawn from the river, rivulet, &c. to convey the water out of its usual current,

Meadow. current, to water the lands laid out for that purpose, by means of lesser mains and trenches. The head-main is made of various dimensions according to the quantity of land to be watered, the length or descent of it, &c. Smaller mains are frequently taken out of the head one; and the only difference is in point of size, the secondary mains being much smaller than the other. They are generally cut at right angles, or nearly so with the other, though not invariably. The use of the the mains, whether great or small, is to feed the trenches with water, which branch out into all parts of the meadow, and convey the water to float the land. By some, these smaller mains are improperly called *Carriages*.

9. A **TRENCH** is a small ditch made to convey the water out of the mains for the immediate purpose of watering the land. It ought always to be drawn in a straight line from angle to angle, with as few turnings as possible. It is never deep, but the width is in proportion to the length it runs, and the breadth of the plane between that and the trench-drain. The breadth tapers gradually to the lower end.

10. A **TRENCH-DRAIN** is always cut parallel to the trench, and as deep as the tail-drain water will admit, when necessary. It ought always, if possible, to be cut down to a stratum of sand, gravel, or clay. If into the latter, a spade's depth into it will be of great advantage. The use of it is to carry away the water immediately after it has run over the panes from the trench. It need not be drawn up to the head of the land by five, six, or more yards, according to the nature of the soil. Its form is directly the reverse of the trench; being narrower at the head, and growing gradually wider and wider until it empties itself into the tail-drain.

11. The **TAIL-DRAIN** is designed as a receptacle for all the water that flows out of the other drains, which are so situated that they cannot empty themselves into the river. It should run, therefore, nearly at right angles with the trenches, though generally it is thought most eligible to draw it in the lowest part of the ground, and to use it to convey the water out of the meadows at the place where there is the greatest descent; which is usually in one of the fence-ditches; and hence a fence-ditch is usually made use of instead of a tail-drain, and answers the double purpose of fencing a meadow and draining it at the same time.

12. A **PANE** of ground, is that part of the meadow which lies between the trench and the trench-drain; and in which the grass grows for hay. It is watered by the trenches, and drained by the trench-drains; whence there is a pane on each side of every trench.

13. A **WAY-PANE** is that part of the ground which lies in a properly watered meadow, on the side of the main where no trenches are taken out, but is watered the whole length of the main over its banks. A drain for carrying off the water from this pane runs parallel to the main. The use is to convey the hay out of the meadows, instead of the teams having to cross all the trenches.

14. A **BEND** is made in various parts of those trenches which have a quick descent, to obstruct the water. It is made, by leaving a narrow strip of green sward across the trench where the bend is intended to

be left; cutting occasionally a piece of the shape of a wedge out of the middle of it. The use is to check the water, and force it over the trench into the panes; which, were it not for these bends, would run rapidly on in the trench, and not flow over the land as it passes along. The great art in watering consists in giving to each part of the pane an equal proportion of water.

15. A **GUTTER** is a small groove cut out from the tails of these trenches where the panes run longer at one corner than the other. The use is to carry the water to the extreme point of the pane. Those panes which are intersected by the trench and tail-drains, meeting in an obtuse angle, require the assistance of gutters to convey the water to the longest side. They are likewise useful, when the land has not been so well levelled, but some parts of the panes lie higher than they ought: in which case, a gutter is drawn from the trench over that high ground, which otherwise would not be overflowed. Without this precaution, unless the flats be filled up (which ought always to be done when materials can be had to do it) the water will not rise upon it; and after the watering season is past, those places would appear rusty and brown, while the rest is covered with beautiful verdure. Our author, however, is of opinion, that this method of treating water-meadows ought never to be followed; but that every inequality in water-meadows should either be levelled or filled up. Hence the waterman's skill is shown in bringing the water over those places to which it could not naturally rise, and in carrying it off from those where it would naturally stagnate.

16. A **CATCH-DRAIN** is sometimes made use of when water is scarce. When a meadow is pretty long, and has a quick descent, and the water runs quickly down the drains, it is customary to stop one or more of them at a proper place, till the water flowing thither rises so high as to strike back either into the tail-drains so as to stagnate upon the sides of the panes, or till it flows over the banks of the drains and waters the grounds below, or upon each side. It is then to be conveyed over the land in such quantity as is thought proper, either by a small main, out of which trenches are to be cut with their proper drains, or by trenches taken properly out of it. In case of a stagnation, the design will not succeed; and it will then be necessary to cut a passage to let the stagnating water run off. Even when the method succeeds best, Mr Boswell is of opinion, that it is not by any means eligible; the water having been so lately strained over the ground, that it is supplied by the water-men not to be endowed with such fertilizing qualities as at first; whence nothing but absolute necessity can justify the practice.

17. A **POND** is any quantity of water stagnating upon the ground, or in the tail-drain, trench-drains, &c. so as to annoy the ground near them. It is occasioned sometimes by the flats not having been properly filled up; at others, when the ware not being close shut, in order to water some grounds higher up, the water is thereby thrown back upon the ground adjacent.

18. A **TURN** of water signifies as much ground as can be watered at once. It is done by shutting down the

Meadow. the hatches in all those wares where the water is intended to be kept out, and opening those that are to let the water through them. The quantity of land to be watered at once must vary according to circumstances; but Mr Boswell lays down one general rule in this case, viz. that no more land ought to be kept under water at one time than the stream can supply regularly with a sufficient quantity of water; and if this can be procured, water as much ground as possible.

19. The **HEAD** of the meadow, is that part of it into which the river, main, &c. first enter.

20. The **TAIL** is that part out of which the river, &c. last passes.

21. The **UPPER SIDE** of a main or trench, is that side which (when the main or trench is drawn at right angles, or nearly so, with the river) fronts the part where the river entered. The lower side is the opposite.

22. The **UPPER PANE** in a meadow, is that which lies on the upper side of the main or trench that is drawn at right angles with the river: where the river runs north and south, it enters in the former direction, and runs out in the southern, the main and trenches running east and west. Then all those panes which lie on the north side of the mains are called *upper panes*; and those on the south side the *lower panes*. But when the mains, trenches, &c. run parallel to the river, there is no distinction of panes into upper and lower.

The instruments used in watering meadows are:

1. A **Water-Level**. The use of this is to take the level of the land at a distance, and compare it with that of the river, in order to know whether the ground can be overflowed by it or not. This instrument, however, is useful only in large undertakings; for such as are on a smaller scale, the workmen dispense with it in the following manner: In drawing a main, they begin at the head, and work deep enough to have the water follow them. In drawing a tail-drain, they begin at the lower end of it and work upwards, to let the tail-water come after them. By this method we obtain the most exact level.

2. The **Line, Reel, and Breast-Plough**, are absolutely necessary. The line ought to be larger and stronger than that used by gardeners.

3. **Spades**. Those used in watering meadows are made of a particular form, on purpose for the work; having a stem considerably more crooked than those of any other kind. The bit is iron, about a foot wide in the middle, and terminating in a point: a thick ridge runs perpendicularly down the middle, from the stem almost to the point. The edges on both sides are drawn very thin, and being frequently ground and whetted, the whole soon becomes narrow; after which the spades are used for trenches and drains; new ones being procured for other purposes. The stems being made crooked, the workmen standing in the trench or drain are enabled to make the bottoms quite smooth and even.

4. **Wheel and Hand barrows**. The former are used for removing the clods to the flat places, and are quite open, without any sides or hinder part. The latter are of service where the ground is too soft to admit the use of wheel-barrows, and when clods are to be re-

moved during the time that the meadow is under **Meadow.** water.

5. **Three-wheeled carts** are necessary when large quantities of earth are to be removed; particularly when they are to be carried to some distance.

6. Short and narrow **Scythes** are made use of to mow the weeds and grass, when the water is running in the trenches, drains, and mains.

7. **Forks**, and long **Crooks** with four or five tines, are used for pulling out the roots of sedge, rushes, reeds, &c. which grow in the large mains and drains. The crooks should be made light, and have long stems to reach wherever the water is so deep that the workmen cannot work in it.

8. Strong **Water-boots**, the tops of which will draw up half the length of the thigh, are indispensably necessary. They must also be large enough to admit a quantity of hay to be stuffed down all round the legs, and be kept well tallowed to resist the running water for many hours together.

The principles on which the practice of watering meadows depend are few and easy.

1. Water will always rise to the level of the receptacle out of which it is originally brought.

2. There is in all streams a descent greater or smaller; the quantity of which is in some measure shown by the running of the stream itself. If it runs smooth and slow, the descent is small; but if rapidly and with noise, the descent is considerable.

3. Hence if a main be taken out of the river high enough up the stream, water may be brought from that river to flow over the land by the side of the river, to a certain distance below the head of the main, although the river from whence it is taken should, opposite to that very place, be greatly under it.

4. Water, sunk under a carriage which conveys another stream at right angles over it, one, two, or more feet below its own bed, will, when it has passed the carriage, rise again to the level it had before.

5. Water conveyed upon any land, and there left stagnant for any length of time, does it an injury; destroying the good herbage, and filling the place with rushes, flags, and other weeds.

6. Hence it is absolutely necessary, before the work is undertaken, to be certain that the water can be thoroughly drained off.

In Mr Wright's treatise upon this subject, the author considers a solution of the three following questions as a necessary preliminary to the operation of watering. 1. Whether the stream of water will admit of a temporary dam or ware across it? 2. Can the farmer raise the water by this means a few inches above its level, without injuring his neighbour's land? 3. Can the water be drawn off from the meadow as quick as it is brought on?—If a satisfactory answer can be given to all these questions, he directs to proceed in the following manner.

Having taken the level of the ground, and compared it with the river, as directed by Mr Boswell, cut a deep wide ditch as near the dam as possible, and by it convey the water directly to the highest part of the meadow; keeping the sides or banks of the ditch of an equal height, and about three inches higher than the general surface of the meadow. Where the mea-

Meadow. **dow** is large, and has an uneven surface, it will sometimes be necessary to have three works in different directions, each five feet wide, if the meadow contains 15 acres; and if the highest part be farthest from the stream. A ditch of 10 feet wide and three deep will commonly water 10 acres of land. When there are three works in a meadow, and flood-hatches at the mouth of each, when the water is not sufficient to cover the whole completely at once, it may be watered at three different times, by taking out one of the hatches, and keeping the other two in. In this case, when the water has run over one division of the land for 10 days, it may then be taken off that and tumbled over to another, by taking up another hatch and letting down the former; by which means the three divisions will have a proper share of the water alternately, and each reap equal benefit. The bottom of the first work ought to be as deep as the bottom of the river, when the fall in the meadow will admit of it; for the deeper the water is drawn, the more mud it carries along with it. From the works, cut, at right angles, smaller ditches or troughs, having a breadth proportioned to the distance to which some part of the water is to be carried, their distance from each other being about 12 yards. A trough two feet wide and one foot deep, will water a surface 12 yards wide and 40 feet long. In each trough as well as ditch place frequent stops and obstructions, especially when the water is rapid, to keep it high enough to flow through the notches or over the sills. Each ditch and trough is gradually contracted in width, as the quantity of water constantly decreases the farther they proceed. Between every two troughs, and at an equal distance from both, cut a drain as deep as you please parallel to them, and wide enough to receive all the water that runs over the adjacent lands, and to carry it off into the master-drain with such rapidity as to keep the whole sheet of water in constant motion; and if possible, not to suffer a drop to stagnate upon the whole meadow. "For a stagnation, says he, (though it is recommended by a Mr D. Young for the improvement of arable land), is what we never admit in our system of watering; for we find that it rots the turf, soaks and starves the land, and produces nothing but coarse grass and aquatic weeds.

"When a meadow lies cold, flat, and swampy, the width of the bed, or the distance between the trough and drain, ought to be very small, never exceeding six yards: indeed, in this case, you can scarcely cut your land too much, provided the water be plentiful; for the more you cut, the more water you require. The fall of the bed in every meadow should be half an inch in a foot: less will do, but more is desirable; for when the draught is quick, the herbage is always fine and sweet. The water ought never to flow more than two inches deep, nor less than one inch, except in the warm months."

Mr Wright proceeds now to answer some objections made by the Reviewers in their account of the first edition of his work. 1. That the Gloucestershire farmers use more water for their lands than is necessary. To this it is answered, That where water is plentiful, they find it advantageous to use even more water than he recommends; and when water is scarce, they choose rather to water only one half, or even a smaller portion of a meadow at a time, and to give that a plentiful covering, than to give a scanty one to the whole. 2. The Reviewers likewise recommend a repeated use of the same water upon different and lower parts of the same meadow, or to make each drain serve as a trough to the bed which is below it. But tho' this method is in some degree recommended by the celebrated Mr Bakewell, and taught by a systematic waterer in Staffordshire, he entirely disapproves of it; excepting where the great declivity of the land will not admit of any other plan. "This cannot (says he) be a proper mode of watering grass-land in the winter-time; for it can be of no service to the lowest parts of the meadow, unless as a wetting in spring or summer. The first or highest part of a meadow laid out according to this plan will indeed be much improved; the second may reap some benefit; but the third, which receives the exhausted thin cold water, will produce a very unprofitable crop. Our farmers never choose more than a second use in the same meadow, and that very seldom; they call even the second running by the significant name of *small-beer*; which, they say, may possibly satisfy thirst, but can give very little life or strength to land (A). It is a much better method to have a meadow laid out so as to be watered at several

Meadow.

¹¹ Objections to his method answered.

¹² A repeated use of the same water is not eligible.

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(A) As by the concurrence of Mr Boswell with this author, and likewise by the agreement of so many practical farmers, it seems established as a fact, that water does really lose its fertilizing properties by running over grass, it may not here be amiss to explain the principle on which it does so.

Under the article AGRICULTURE, we have shown at some length, that the true food of plants is the parts of animal and vegetable substances dissolved and volatilized by putrefaction, in such a manner that they can be absorbed by the vessels of other plants, and thus become part of their substance. There are two ways in which these effluvia may be dissolved, viz. in air and in water; of consequence, air and water are the two media by which the food of plants is applied to them, and by means of which they are augmented in bulk. From the analysis of these two elements, it is known that both of them, at least in their ordinary state, contain a great quantity of volatilized earthy matter, which sometimes strikes our senses very forcibly when first emitted by putrefying bodies; but on being thoroughly dissolved by the atmosphere, it totally eludes them, and becomes the PHLOGISTON concerning which such violent disputes have arisen. This fine volatilized matter is absorbed from the atmosphere by the leaves of the plants, and from the water by their roots. Hence both elements, when loaded with vapours of this kind, are more favourable to vegetation than when in their pure state. Thus plants will thrive very well in putrid air, while they languish and die in the pure dephlogisticated kind. Just so it is with the element of water. When this is loaded with a great quantity of putrid matter, it readily parts with it not only to the roots of plants, but to the atmosphere also; whence such vegetables as it

has

Meadow.

veral times, and to be at the expence of several small flood-hatches, than to water the whole of it at once by means of catch-drains.

" Sometimes it is necessary, in a large meadow, to convey the water that has been used under the works and troughs; and then the water above is supported by means of boards and planks, which we call a *carry-bridge*. Sometimes, the better to regulate the course of the water on the surface, especially in the spring, narrow trenches are dug, and the mould laid by the side of them, in order to be restored to its former place when the watering is finished. The earth and mud thrown out in cleansing and paring the ditches should be carried to fill up the low hollow parts of the meadow, and be trodden down with an even surface; which will easily be done when the water is on, the waterman being always provided with a strong pair of water-proof boots. If the mould thus used has upon it a turf that is tolerably fine, place it uppermost; but if it is sedgey and coarse, turn it under, and the water if it runs quick will soon produce a fine herbage upon it.

" The grounds that are watered in the easiest and most effectual manner, are such as have been ploughed and ridged up in lands about twelve yards wide. Here the water is easily carried along the ridge by means of a small ditch or trough cut along its summit, and then, by means of the flaps in it, is made to run down the sides or beds into the furrows, by which it is carried into the master drain, which empties itself into the river. Every meadow, before it is well watered, must be brought into a form something like a field that has been thus left by the plough in a ridged state. Each side of the ridge should be as nearly as possible an exact inclined plane, that the water may flow over it as equally as may be." Mr Wright does not, like Mr. Boswell, disapprove of the use of flood-hatches; he only gives the following hint, viz. that their basis should be deep and firmly fixed, well secured with stone and clay, that it be not blown up. The following directions are given for each month of watering:

73
Of cleaning
and repair-
ing the
works.

74
Thick and
muddy wa-
ter to be u-
sed when it
can be
done.

In the beginning of November, all the ditches, troughs, and drains, are to be thoroughly cleaned by the spade and breast-plough, from weeds, grass, and mud; and well repaired, if they have received any injury from cattle. After a shower, when the water is thick and muddy, turn over the meadow as much water as you can without injuring the banks of the works, especially if the land be poor; as in this month, according to our author, the water contains many more fertilizing particles, which he calls *salts* and *richness*, than later in the winter. In defence of this position, of which it seems the Monthly Reviewers have doubted, our author urges, that though he is not able to prove it by any chemical analysis, yet it seems evident,

that " after the first washing of farm yards, various Meadow. flasks, ditches, and the surface of all the adjoining fields, which have lain dry for some time, the common stream should then contain much more fatness than when the same premises have been repeatedly washed." This is confirmed by the experience of the Gloucestershire farmers; who, if they can at this season of the year procure plenty of muddy water to overflow their grounds for one week, look upon it to be equally valuable with what is procured during all the rest of the winter. In support of this, he quotes the following words of Mr Forbes, in a treatise on watering: " The water should be let in upon the meadow in November, when the first great rains make it muddy, for then it is full of a rich sediment, brought down from the lands of the country through which it runs, and is washed into it by the rain; and as the sediment brought by the first floods is the richest, the carriages and drains of the meadow should all be scoured clean and in order, before these floods come."

" In opposition (adds Mr Wright) to the opinion of practical waterers, that the muddiness of the water is of little consequence. I hesitate not to affirm, that the mud is of as much consequence in winter-watering, as dung is in the improvement of a poor upland field. For each meadow in this neighbourhood is fruitful in proportion to the quantity of mud that it collects from the water. And, indeed, what can be conceived more enriching than the abundant particles of putrid matter which float in the water, and are distributed over the surface of the land, and applied home to the roots of the grass. It is true, that any the most simple water thrown over a meadow in proper quantity, and not suffered to stagnate, will shelter it in winter, and in the warmth of spring will force a crop; but this unusual force must exhaust the strength of the land, which will require an annual supply of manure in substance, or, in a course of years, the soil will be impaired rather than improved. The meadows in this county, which lie next below a market-town or village are invariably the best; and those which receive the water after it has been two or three times used, reap proportionably less benefit from it: For every meadow that is well laid out, and has any quantity of grass upon its surface, will act as a fine sieve upon the water, which, though it flow in ever so muddy, will be returned back to the stream as clear as it came from the fountain. This circumstance, when there is a range of meadows to be watered, the property of different persons, when water is scarce, creates vehement contentions and struggles for the first use of it. The proprietors are therefore compelled to agree among themselves, either to have the first use alternately, or for the higher meadows to dam up, and use only one half or a less portion of the river. Our farmers

know

has access to, arrive at the utmost luxuriance of growth. If the water is more pure, still they will thrive very well; but the luxuriance of vegetation is less than in the former case. At last, however, when the water has parted with a certain quantity of phlogistic matter, the process of vegetation is incapable of separating any more; and therefore such water, though applied to the roots of vegetables, cannot communicate to them any remarkable increase. Nay, it is by no means improbable, that after water has arrived at this state, it will, instead of giving any fresh nourishment to the plants, again deprive them of the nourishment which they have already received; and this is probably what Mr Boswell means, when, in the passage formerly quoted, he calls the water *hungry*.

Meadow. know the mud to be of so much consequence in watering, that whenever they find it collected at the bottom of the river or the ditches, they hire men whole days to disturb and raise it with rakes made for the purpose, that it may be carried down by the water, and spread upon their meadows. One meadow in South Cerney, I think, is an incontestible proof of the consequence of muddy water. It is watered by a branch of the common stream that runs for about half a mile down a public road. This water, by the mud on the road being continually disturbed by carriages and the feet of cattle, becomes very thick, and when it enters the meadow is almost as white as milk. This field, which consists of seven acres, was a few years ago let for 10 s. an acre, but is already become the richest land in the parish, and has produced at one crop eighteen loads of hay, and each load more than 25 hundred weight."

Instance of the good effects of muddy water. 16 Mr Wimpey's opinion upon the subject. In further confirmation of what our author asserts, he quotes, from the Annals of Agriculture, the following words of Mr Wimpey: "As to the sorts of water, little is to be found, I believe, which does not encourage and promote vegetation, even the most simple, elementary, and uncompounded fluid: heat and moisture, as well as air, are the *fine qua non* of vegetation as well as animal life. Different plants require different proportions of each to live and flourish; but some of each is absolutely necessary to all. However, experience as well as reason universally shows, that the more turbid, feculent, and replete with putrescent matter the water is, the more rich and fertilizing it proves. Hasty and impetuous rains, of continuance sufficient to produce a flood, not only dissolve the salts, but wash the manure in substance off the circumjacent land into the rapid current. Such turbid water is both meat and drink to the land; and, by the unctuous sediment and mud it deposits, the soil is amazingly improved and enriched. The virtue of water from a spring, if at all superior to pure elementary water, is derived from the several strata or beds of earth it passes through, that, according to the nature of such strata, it may be friendly or otherwise to vegetation. If it passes through chalk, marble, fossil shells, or any thing of a calcareous nature, it would in moist soils promote the growth of plants; but if through metallic ores, or earth impregnated with the vitriolic acid, it would render the land unfertile, if not wholly barren. In general the water that has run far is superior to that which immediately flows from the spring, and more especially that which is feculent and muddy, consisting chiefly of putrid animal substances washed down the stream."

Confirmed by Mr Forbes. 17 To the same purpose also says Mr Forbes: "There is great difference in the quality of water, arising from the particles of different kinds of matter mixed with them. Those rivers that have a long course through good land are full of fine particles, that are highly fertilizing to such meadows as are usually overflowed by them; and this chiefly in floods, when the water is fullest of a rich sediment: for when the water is clear, though it may be raised by art high enough to overflow the adjoining lands, and be of some service to them, the improvement thus made is far short of what is obtained from the same water when it is thick and muddy."

Mr Boswell, though quoted by Mr Wright as an advocate for the doctrine just now laid down, seems, in one part of his work at least, to be of a contrary opinion. This is in the 14th chapter of his book, where he remarks upon another publication on the same subject, the name of which he does not mention: "In page 4th of that pamphlet (says Mr Boswell), the writer informs us, 'if the water used be always pure and simple, the effect will by no means be equal to the above; that is, of a stream that is sometimes thick and muddy. We have a striking instance of this in two of our meadows, which are watered immediately from springs that arise in the grounds themselves. Their crops are early and plentiful, but not of a good quality, and the land remains unimproved after many years watering.'

"The writer of this treatise (Mr Boswell), in a former edition, had asserted, and in this repeated, the contrary effects from a stream very near the spring-head, as clear as crystal.

"The gentleman (Mr Beverly of Keld) whom that writer mentions in his preface, made a short visit last spring into Dorsetshire, to satisfy himself of the fact. The editor had the pleasure to show him the stream alluded to, which he traced almost to the fountain-head. It was perfectly clear, and the water was then immediately conveyed out of the stream upon the lands adjoining, some of which it was then running over; others it had been upon, and the verdure was then appearing. The gentleman expressed himself perfectly satisfied with the fact. To him the editor wishes to refer, &c. Mr George Culley of Fenton near Wooler in Northumberland, with a truly noble and public spirit that does him great honour as a friend to his country, sent a very sensible young man from thence into Dorsetshire, to learn the art of watering meadows, and to work the whole season in those meadows under different watermen. This man was often over those meadows, and worked in some just below that were watered by the same stream. Might the editor presume to offer his opinion upon this seeming contradiction, it is very probable that the soils, both the upper and under strata, are very different, as well as those through which the different springs run."

From this passage, the latter part of which is not very intelligible, we might conclude that Mr Boswell prefers clear to muddy water for overflowing meadows. In his chapter on land-floods, however, he expresses himself as follows: "They will (says he) always be found of great use where the sweepings of towns, farm-yards, &c. are carried down by them; seldom any other erection is wanting besides a sluice or small ware to divert and convey them over the lands. If the situation of the land happens to be on the side of a hill, catch-drains are absolutely necessary for watering the lower part of the hill, after the water has been used upon the upper. In many parts of the kingdom, where there are large hills or extensive rising lands, great quantities of water-run from them into the valleys after heavy rains: These might with proper attention be collected together before they get to the bottom or flat ground, and from thence be diverted to the purpose of watering those lands that lie below, with great advantage to the occupier, and at

Meadow. a small expence. And should the land thus situated be arable, yet it would be found a beneficial exchange to convert it into pasture; particularly if pasture-ground should be a desirable object to the occupier. The method of performing it is thus recommended. Observe the piece of land or field best adapted to the purpose, both for situation and soil. If it should be arable, make it first very level; and with the crop of corn sow all sorts of hay seeds; and as soon as it has got a green sward it may be laid out. In the lowest part of the ground draw a deep ditch for the current to run in through it; and continue it into some ditch or low part in the lands below, that the water may be freely carried off, after it has been and while it is in use. Draw ditches above the field intended to be watered assant the sides of the hill, in such a manner that they may all empty themselves into the head of the ditch above-mentioned, just where it enters the field to be watered: then erecting a ware across this ditch, the field will be capable of being watered, according to the situation of the ditch in the middle or on the side of the field. It must then be conveyed by small mains or trenches, and subdivided again by branch-trenches, according to the site of the field and the quantity of water that can be collected; trench-drains must be drawn, and the water conveyed into the ditch by means of tail-drains. A person unacquainted with water-meadows cannot conceive the advantage arising from water thus collected and conveyed over this species of water-meadow (if it may be so called), being generally a firm good soil; for the water running down from rich cultivated hills, eminences, &c. sweeps away with it, when the rain falls very heavy, vast quantities of dung dropped by sheep and other cattle, and the manure carried upon arable lands; all which being now diverted, and carried over the meadow with an easy descent, gives time for the particles of manure to subside upon the ground at one season, or of being filtered from it as it dribbles through the grafs at another; after which the warm weather pushes on vegetation amazingly. Meadows thus situated would be vastly superior to any other, if they had the advantage of a constant stream; but even as they are, taking the opportunity of watering them by every heavy rain or flood that happens, they will be found to be very valuable. The occupier of such lands is strenuously advised to let no time be lost in appropriating them to this use; because these lands are healthy for all kinds of cattle at almost all seasons; and the expence of converting them into this kind of water-meadow is exceeding small, the annual charges afterwards quite trifling, and the produce very considerable."

Mr Wright's directions for watering through the different months of the year. "In December and January, the chief care consists in keeping the land sheltered by the water from the severity of frosty nights. It is necessary, however, through the whole winter, every ten days or fortnight to give the land air, by taking the water off entirely, otherwise it would rot and destroy the roots of the grafs. It is necessary, likewise, that a proper person should go over every meadow at least twice every week, to see that the water is equally distributed, and to re-

move all obstructions arising from the continual influx of weeds, leaves, sticks, and the like. In February, a great deal depends upon care and caution. If you now suffer the water to remain on the meadow for many days without intermission, a white scum is raised, very destructive to the grafs; and if you take off the water, and expose the land to a severe frosty night, without its being previously dried for a whole day, the greatest part of the tender grafs will be cut off. The only ways to avoid both these injuries are, either to take the water off by day to prevent the scum, and to turn it over again at night to guard against the frost; or, if this practice be too troublesome, both may be prevented by taking the water entirely off for a few days and nights, provided the first day of taking off be a dry one; for if the grafs experience one fine drying day, the frost at night can do little or no injury. The scum is generated chiefly by the warmth of the sun, when the water is thin and used too plentifully. Towards the middle of this month we vary our practice in watering, by using only about half the quantity of water which is made use of earlier in the winter, all that is now required being to keep the ground in a warm moist state, and to force vegetation.

"At the beginning of March, the crop of grafs in the meadows is generally sufficient to afford an abundant pasturage for all kinds of stock, and the water is taken off for near a week, that the land may become dry and firm before the heavy cattle are turned in.—It is proper, the first week of eating off the spring-feed, if the sea-n be cold, to give the cattle a little hay each night."

"It is a custom (says Mr Wright) with some farmers in Hampshire, to eat off the spring-graſs of their meadows with ewes and lambs, in the same manner that we do a field of turnips, by inclosing a certain portion each day with hurdles or stakes, and giving them hay at the same time. This is certainly making the most of the grafs, and an excellent method to fine and sweeten the future herbage. In this month and April, you may eat the grafs as short and close as you please, but never later; for if you trespass only one week on the month of May, the hay-crop will be very much impaired, the grafs will become soft and woolly, and have more the appearance and quality of an after-math than a crop. At the beginning of May, or when the spring feeding is finished, the water is again used for a few days by way of wetting."

"It is rather remarkable, that watering in autumn, winter, or spring, will not produce that kind of herbage which is the cause of the rot in sheep; but has been known to remove the cause from meadows, which before had that baneful effect. If, however, you use sheep the water only a few days in any of the summer months, all the lands thus watered will be rendered unsafe for the pasturage of sheep. Of this I was lately convinced from an experiment made by a friend. At the beginning of July, when the hay was carried off, and the water rendered extremely muddy and abundant by several days rain, he thought proper to throw it over his meadows for ten days, in which time a large collection of extremely rich manure was made upon the land. In about a month the meadow was covered with uncommon luxuriancy and blackness of herbage. Into this grafs were turned eight

Meadow.

22
Of eating
off the
spring grafs
with ewes
and lambs.

23
How water-
ing may
occasion
the rot in
sheep.

^{Meadow.} eight found ewes and two lambs. In six weeks time the lambs were killed, and discovered strong symptoms of rotteness; and in about a month afterwards one of the ewes was killed, and though it proved very fat, the liver was putrid and replete with the insect called the *fish*, or *swarm*: the other ewes were sold to a butcher, and all proved unsound. This experiment, however, convinces me, by the very extraordinary improvement made thereby in the meadow, that muddy water in the summer is much more enriching than it is in autumn or winter; and ought, therefore, to be used for a week at least every wet summer, notwithstanding its inconveniences to sheep, the most profitable species of stock."

Mr Boswell, besides his general directions for watering, gives many plans of the ditches, drains, &c. for particular meadows, some of them done from an actual survey. But these being confined to particular situations, we shall here only speak of his method in general. In his third chapter, intitled *A general Description of Water-meadows*, he observes, that "lands capable of being watered, lie sometimes only on one side and sometimes on both sides of the stream designed to supply them with water. In the former case, when they have a pretty quick descent, the land may be often watered by a main drawn out of the stream itself, without any ware; though he acknowledges that it is by far the best way to erect a ware, and to draw mains on each side, to dispose of the water to the best advantage.

Boggy lands require more and longer continued watering than such as are sandy or gravelly; and the larger the body of water that can be brought upon them, the better. The weight and strength of the water will greatly assist in compressing the soil, and destroying the roots of the weeds that grow upon it; nor can the water be kept too long upon it, particularly in the winter season; and the closer it is fed, the better.

To improve clay soils, we must endeavour to the utmost to procure the greatest possible descent from the trench to the trench drain; which is best done by making the trench-drains as deep as possible, and applying the materials drawn out of them to raise the trenches. Then, with a strong body of water, taking the advantage of the autumnal floods, and keeping the water some time upon them at that season, and as often as convenient during the winter, the greatest improvement on this sort of soils may be made.

Warm sand or gravelly soils are the most profitable under the watering system, provided the water can be brought over them at pleasure. In soils of this kind, the water must not be kept long at a time, but often shifted, thoroughly drained, and the land frequently refreshed with it: under which circumstances the profit is immense. A spring-feeding, a crop of hay, and two aftermaths, may be obtained in a year; and this, probably, where in a dry summer scarce grass enough could be found to keep a sheep alive. If the stream be large, almost any quantity of land may be watered from it; and though the expence of a ware over it is great, it will soon be repaid by the additional crop. If the stream is small, the expence will be so in proportion.

The following method of improving a water-me-

dow that was springy has been tried by Mr Boswell with success. The meadow had been many years watered by a spring rising just above it from a barren sandy heath; the soil near the surface was in some places a gravelly sand, in others a spongy cork, both upon a strong clay and sand mixture, which retained the draining of the lands above it. Whenever it had been watered, and left to drain itself dry, a yellowish-red water stood in many parts, and oozed out of others; the herbage being no other than a poor, miserable, hairy grass and small sedge. Chalk and ashes had been thrown over it to very little purpose. It was then drained underground almost all the different descents, and all these drains carried into one large drain, which had been already cut for the purpose of carrying off the water when the meadow was overflowed. These drains were cut quite through the mixture of clay and sand, and as much deeper as the fall of the ground below would admit of; then, with chalk cut for the purpose, small hollow drains were formed at the bottom of these; the drains were then filled up with the materials that came out.

This was done in the beginning of summer, and the work frequently examined through the season; the soil was found firmer than before, and none of that nasty red water to be met with upon the surface, though it continually oozed into the drains. In autumn the meadow was again prepared for waterings, by repairing those trenches and drains that were properly situated; cutting others where wanted, for the purpose of watering meadows. The water being then brought over it from the same spring as before, the event answered the most sanguine wishes of the proprietor; the effects were visible the first year, and the ground has been constantly improving ever since.

Mr Boswell also informs us, that a gentleman in Scotland had applied to him for directions to water some lands lying on the sides of hills, where the descent is quick; and of which there are many in this country, as well as in the north of England. It would be difficult to water such lands by means of drains and trenches according to the directions already given; because the bends in the trenches must be very near together and large, as the water must flow out of the trench above the bend to flow over the pane below it; the number and size would likewise be inconvenient, and greatly offend the eye.

Lands of this sort are generally capable of being ploughed; in which case our author directs them to be once ploughed in the spring, and sown with oats or any other kind of grain that will rot the furrow. When the grain is harvested, plough the land across; the last ploughing with the Kentish plough, which has a moveable mold-board, and is called a *turn-wrist* plough. This turns the furrows down the side of the hill, the horses going forwards and backwards in the same furrows. By this means the land is laid flat without any open furrows in it: drest it down in the spring very fine, and sow it with oats, and mix with some kinds of grass seeds very thick. Thus the ground will have but few irregularities; and as soon as the corn is carried off, or the following spring at farthest, the mains and drains may be cut out.

For watering coarse lands that are firm enough to bear

^{Meadow.}

²⁵ Method of improving a springy water-meadow.

²⁶ Of watering lands on the sides of hills.

²⁴ Mr Boswell's general directions for watering.

Meadow. bear the plough, and situated near a stream, our author gives the following directions.

27
Of water-
ing coarse
lands.

"Let the land thus situated be ploughed once in the spring, and sown with any grain that will rot fward. As soon as the crop is off, plough it again, and leave it rough through the winter. Work it down early in the spring, and plough it in the direction the trenches are to lie, making the ridges of a proper size for watering, ten or twelve yards wide for instance; work it fine; then gather the ridges up again in the same manner, making the last furrows of each ridge as deep as possible. If the land be not fine, dress it down again, and gather it up a second time if necessary; and with a shovel throw the earth from the edges of the furrows to the tops of the ridges, to give the greatest possible descent from the trench to the drain. Sow it with oats and grafs seeds very thick; and after the corn is carried off, the trenches may be formed upon the top of each ridge, dispersing the furrows with a spade as much as the fall of the land will admit of for the drains; taking care to procure sufficient fall at all events, to drain the lands after they have been watered. By this method the crops of corn will nearly pay all the expence, and the land will be in excellent order.

28
Of the ma-
nagement
of mea-
dows after
watering.

After the work of watering a meadow is totally finished, and the hay carried off, cattle may be let in to eat the after-math. When this is done, it will then be necessary to examine whether or not the mains have suffered any injury from their feet; whether there be quantities of mud or sand collected at the angles, &c. all of which must be thrown out and the breaches repaired; by which means the trenches, drains, &c. will last three years, but otherwise not more than two. The roots, mud, &c. may be used in repairing the breaches, but never left upon the sides of the trenches out of which they are taken. The tail-drains require to be cleaned oftener than any of the other works, for this obvious reason, that the mud, &c. is carried down from all the others into them; where if it be allowed to accumulate, it occasions a stagnation of water upon the meadow itself. In repairing the trenches, particular care ought to be taken that the workmen do not make them any wider than before, which they are very apt to do; neither are they to be allowed to throw the materials which they dig out in a ridge behind the edge of the trench, which both widens it and promotes weeds.

29
Of the
water
should con-
tinue upon
the mea-
dows.

During the time of watering, it will be necessary to examine the meadow every two or three days in order to remove obstructions, &c. If the drains should be filled with water and run over, they ought to be made deeper; or if this cannot be done, they should be widened. In the winter time a regular strong water should be kept, avoiding very strong great floods. In this season the water may be kept on the ground with safety for a month or even six weeks if the soil be corky or boggy or a strong clay; but not quite so long if it be gravel or sand. At the second watering a fortnight or three weeks will be sufficient; and after Candlemas a fortnight will be rather too long. At the third watering a week will be sufficient, which will bring it to about the middle of March; by which time, if the weather be tolerably mild, the grafs will be long enough for the ewes and lambs, or for fattening

lambs; which may then be turned into the meadow with great advantage. Even in the end of February, if the winter has been very mild, the grafs will be long enough for them. Here they may be permitted to feed till the beginning of May, changing them into different meadows. As soon as they are taken out, the water must be turned in for a week, carefully examining every trench and drain for the reasons already given. The water is then to be shifted into others, alternately watering and draining, lessening the time the water remains upon it as the weather grows warmer; and in five, six, or seven weeks, the grafs will be fit to be mown for hay, and produce from one to two tons, or even more, an acre upon good ground.

Mr Boswell directs, that about a week before the grafs is to be mown the water should be let into the meadow for 24 hours; which, he says, will make the ground moist at the bottom, the scythe will go thro' it the more easily, and the grafs will be mown closer to the ground. This practice, however, is entirely disapproved of by Mr Wright. "Though it may prevail in Dorsetshire (says he), it is very feldom advisable, for the following reasons: Water made to run through a thick crop of grafs, though it may appear ever so pure, will leave a certain quantity of adherent scum or sediment, which can never be separated from the hay, but will render it unpalatable, if not prejudicial, to the cattle that eat it. And this wetting of the land and grafs will impede the drying or making of the hay perhaps some days, which in difficult seasons is of very great consequence; and it will likewise make the turf too soft and tender to support the wheels of a loaded waggon in carrying off the hay. Besides, there is reason to believe that one day's wetting in the summer will, upon most meadows, endanger the soundness of every sheep that feeds upon the after-math."

The spring-feeding ought never to be done by heavier cattle than sheep or calves; for larger cattle do much hurt by poaching the ground with their feet, destroying the trenches, and spoiling the grafs. Mr Boswell likewise greatly recommends a proper use of spring floods, from which he says much benefit may be derived; but if there is any quantity of grafs in the meadows not eaten, these floods must be kept out, otherwise the grafs will be spoiled; for they bring with them such quantities of sand and mud, which stick to the grafs, that the cattle will rather starve than taste it. Great quantities of cgrafs or aftermath are frequently spoiled in flat countries by the floods which take place in the fall. In the winter-time, however, when the ground is bare, the sand and mud brought down by the floods is soon incorporated with the soil, and becomes an excellent manure. The certain rule with regard to this matter is, "Make use of the floods when the grafs cannot be used; avoid them when the grafs is long or soon to be cut."

"It has often been a subject of dispute (says Mr Boswell), whether, from the latter end of autumn to Candlemas, the throwing a very strong body of water, where it can be done, over the meadows, is of any essential service or not? Those who consider it as advantageous, assert, that when the waters run rude and strong over the ground, they beat down and rot the tufts

Meadow.

30
Of spring
feeding.

31
Of water-
ing from
the end of
autumn to
Candlemas.

Meadow.

tufts of foggy or rough grass, sedge, &c. that are always to be found in many parts of coarse meadow-ground; and therefore are of peculiar service to them. On the other side it is alleged, that by coming in so large a body, it beats the ground (in the weak places particularly) so bare, that the sward is destroyed; and also brings with it such quantities of seeds of weeds, that at the next hay season the land in all those bare places bears a large burden of weeds, but little grass.

"The general opinion of the watermen upon this point is, that in water meadows which are upon a warm, sandy, or gravelly soil, with no great depth of loam upon them, rude strong watering, even in winter, always does harm without any possible essential service. On the contrary, cold strong clay land will bear a great deal of water a long time without injury; and boggy, corky, or spongy soil, will also admit of a very large and strong body of water upon it; provided the drains are made wide and deep enough to carry it off, without forcing back upon the end of the panes, with great advantage for almost any length of time at that season. The weight and force of the water vastly assists in compressing those soils, which only want solidity and tenacity to make them produce great burthens of hay: nothing, in their opinion, corrects and improves those soils so much as a very strong body of water, kept a considerable time upon them at that season."

Notwithstanding the above reasons, however, Mr Boswell informs us, That he has doubts upon the subject; nor can he by any means acquiesce in this opinion, unless by rude strong waters he is permitted to understand only rather a larger quantity of water conveyed over the land at this early season than ought to be used in the spring or summer: unmanageable waters he believes always hurtful.

"It may be proper just to add (continues he), that as soon as the hay is carried off the meadows, cattle of any sort except sheep may be put to eat the grass out of the trenches, and what may be left by the mowers. This perhaps will last them a week; when the water may be put into the meadows in the manner already described, taking care to mow the long grass which obstructs the water in the trenches; and this mowing is best done when the water is in them. Let the weeds, leaves, &c. be taken out and put in heaps, to be carried away into the farm-yards; examine the trenches, make up the breaches, &c. take particular care that the water only dribbles over every part of the panes as thin as possible, this being the warmest season of the year. The first watering should not be suffered to last longer than two or three days before it is shifted off (and if the season be wet, perhaps not so long, as warmth seems to be the greatest requisite after the land is once wet to assist vegetation) to another part or meadow beat out by the cattle, by this time fit to take it. Do by this meadow exactly the same, and so by a third and fourth, if as many meadows belong to the occupier. Observe at all times, when the water is taken out of a meadow, to draw up the drain-slucce hatches; as, without doing that, watering is an injury. By the time that three or four parts are thus regularly watered, the first will have an after-math, with such rich and beautiful verdure as will be astonishing; and both quantity and quality will be beyond conception better than if the lands had not been watered.

Meadows:
Meal.

"Hence we see why every person should if possible have three or four meadows that can be watered; for here, while the cattle are eating the first, the second is growing, the third draining, &c. and the fourth under water. In this manner the after-math will in a mild season last till Christmas. A reason was given why the spring-grass should be fed only by sheep or calves; a reason equally cogent may be given, why the after-grass ought not to be fed by them, because it will infallibly rot them. "No sheep (says our author), except those which are just fat, must ever be suffered even for an hour in water-meadows except in the spring of the year; and even then care must be taken that every part of the meadows have been well watered, and that they are not longer kept in them than the beginning of May. Although at present it is unknown what is the occasion of the rot, yet certain it is that even half an hour's feeding in unhealthy ground has often proved fatal. After a short time they begin to lose their flesh, grow weaker and weaker: the best feeding in the kingdom cannot improve them after they once fall away; and when they die, animalcula like plaice are found in the livers. Scarcely any ever recover from a slight attack; but when farther advanced, it is always fatal. Guard by all means against keeping the water too long upon the meadow in warm weather; it will very soon produce a white substance like cream, which is prejudicial to the grass, and shows that it has been too long upon the ground already. If it be permitted to remain a little longer, a thick scum will settle upon the grass of the consistence of glue, and as tough as leather, which will quite destroy it wherever it is suffered to be produced. The same bad effects seem to arise from rude waters; neither can the scum easily be got off.

"Rolling meadows in the spring of the year is an excellent method. It should be done after Candlemas, when the meadow has been laid dry a week. It should be always rolled lengthwise of the panes, up one side of the trench and down the other. Rolling also contributes much to the grass being cut close to the surface when mown, which is no small advantage; for the little hillocks, spawnings of worms, ant-hills, &c. are by this means pressed close to the ground, which would otherwise obstruct the scythe and take off its edge; and to avoid that inconvenience, the workmen always mow over them."

MEAL, the flour of grain. The meal or flour of Britain is the finest and whitest in the world. The French is usually browner, and the German browner than that. Our flour keeps well with us, but in carrying abroad it often contracts damp, and becomes bad. All flour is subject to breed worms; these are white in the white flour, and brown in that which is brown: they are therefore not always distinguishable to the eye; but when the flour feels damp, and smells rank and musty, it may be conjectured that they are there in great abundance.

The colour and the weight are the two things which denote the value of meal or flour; the whiter and the heavier it is, other things being alike, the better it always is. Pliny mentions these two characters as the marks of good flour; and tells us, that Italy in his time produced the finest in the world. This country indeed was famous before his time for

32
Water
ought not
to be kept too
long upon
meadows.

33
Advantage
of rolling
meadows.

Meal.

this produce; and the Greeks have celebrated it; and Sophocles in particular says, that no flour is so white or so good as that of Italy. The corn of this country has, however, lost much of its reputation since that time; and the reason of this seems to be, that the whole country being full of sulphur, alum, vitriol, marcasites, and bitumens, the air may have in time affected them so far as to make them diffuse themselves through the earth, and render it less fit for vegetation; and the taking fire of some of these inflammable minerals, as has sometimes happened, is alone sufficient to alter the nature of all the land about the places where they are.

The flour of Britain, though it pleases by its whiteness, yet wants some of the other qualities valuable in flour; the bread that is made of it is brittle and does not hold together, but after keeping a few days becomes hard and dry as if made of chalk, and is full of cracks in all parts; and this must be a great disadvantage in it when intended for the service of an army or the like occasions, where there is no baking every day, but the bread of one making must necessarily be kept a long time.

The flour of Picardy is very like that of Britain; and after it has been kept some time, is found improper for making into paste or dough. The French are forced either to use it immediately on the grinding, or else to mix it with an equal quantity of the flour of Brittany, which is coarser but more unctuous and fatty; but neither of these kinds of flour keep well.

The flour of almost any country will do for the home consumption of the place, as it may be always fresh ground; but the great care to be used in selecting it is in order to the sending it abroad, or furnishing ships for their own use. The saline humidity of the sea-air rusts metals, and fouls every thing on board, if great care be not taken in the preserving them. This also makes the flour damp and mouldy, and is often the occasion of its breeding insects, and being wholly spoiled.

The flour of some places is constantly found to keep better at sea than that of others; and when that is once found out, the whole caution needs only be to carry the flour of those places. Thus the French find that the flour of Poitou, Normandy, and Guienne, all bear the sea-carriage extremely well; and they make a considerable advantage by carrying them to their American colonies.

The choice of flour for exportation being thus made, the next care is to preserve it in the ships: the keeping it dry is the grand consideration in regard to this; the barrels in which it is put up ought to be made of dry and well-seasoned oak, and not to be larger than to hold two hundred weight at the most. If the wood of the barrels have any sap remaining in it, it will moisten and spoil the flour; and no wood is so proper as oak for this purpose, or for making the bins and other vessels for keeping flour in at home, since when once well dried and seasoned it will not contract humidity afterwards. The beech-wood, of which some make their bins for flour, is never thoroughly dry, but always retains some sap. The fir will give the flour a taste of turpentine; and the ash is always subject to be eaten by worms. The oak is preferable, because of its being free from these faults; and when the several

kinds of wood have been examined in a proper manner, there may be others found as fit, or possibly more so, than this for the purpose. The great test is their having more or less sap. See *Flour* and *Wood*.

MEAN, in general, denotes the middle between two extremes: thus we say the mean distance, mean proportion, &c.

MEARNS, or KINCARDINSHIRE, a county of Scotland, bounded on the north by Aberdeenshire, on the east by the British Ocean, and on the south-west by Angushire. In form it resembles a harp, having the lower point towards the south. Its length along the coast is scarce 30 miles; its greatest breadth about 20. Some derive the first name from Mearns a valiant nobleman, who, subduing the country, received it in reward from his prince Kenneth II. Camden, with much probability, supposes it to retain part of the name of the old inhabitants, the Vernicones of Ptolemy, it being common for the Britons in discourse to change the V into M. The other name is taken from its ancient capital *Kincardine*, now an inconsiderable village. The tract of country through which the Dee passes, and the plain along the sea-coast, are well cultivated, and produce much corn and flax. The fields are in many places screened by woods; and the heaths afford sheep-walks and much good pasture for cattle. Near Stonehaven, to the south, are the ruins of Dunottar castle, the ancient seat of the earls Marischal of Scotland, situated on a high perpendicular rock, almost surrounded by the sea. In this neighbourhood is a precipitous cliff over-hanging the sea, called *Fossil's Cleugh*; noted as the resort of kittiwakes, the young of which are much sought after in the hatching season, being esteemed a great delicacy.—At a little distance from Stonehaven, up the river, stands Urie, the birth-place of Barclay the famous apologist for the Quakers. The Quakers have here a burying ground; and in the vicinity are seen the traces of a Roman station. The great valley called *Strathmore* commences here, and extends in a south-west direction nearly as far as Benlomond in Stirlingshire, bounded all along to the north-west by the Grampian mountains.—The village of Fordun, a little south from the centre of the country, is supposed to be the birth-place of the celebrated author of the *Scotchichronicon*. St Paddy's church, or Paldy kirk in this neighbourhood, is famous for being the burial-place and residence of St Palladius; whose chapel is still to be seen on the south side of it, 40 feet by 18, now the burial-place of the Halkerton-family. Near the village, and along the river Bervie, the country is flat and well cultivated. The small town of *INVERBERVIE* was made a royal borough by David Bruce, who landed there with his queen at Craig David after his long retreat into France. Near the village of *Fettercairn* was Den Finnel, the residence of Finella, daughter of a nobleman of large possessions in this country, or, as Major calls her, *countess of Angus*, who was accessory to the murder of Kenneth II. About two miles from this place, on the road-side, is a cairn of a stupendous size and uncommon form, which probably might give name to the parish. About six miles west from Bervie, is situated *Laurence-kirk*, which some years back was only an insignificant village of six or seven houses; but by the judicious and liberal exertions of its proprietor Lord Gardenstone, has

Measures,
Measure.

has become a handsome little town, with a right to elect magistrates, and to hold an annual fair and a weekly market. He has established here a flourishing and extensive manufacture of lawn, cambric, linen, and various other articles. He has also freely renounced all the oppressive services due by his tenants; services which have been so long and so justly complained of as a check to agriculture in many parts of Scotland.—The north-west part of the shire, being mountainous, is more employed in pasture than in cultivation.

MEASLES, a cutaneous disease attended with a fever, in which there is an appearance of eruptions that do not tend to a suppuration. See (the *Index* subjoined to) **MEDICINE**.

MEASURE, in geometry, denotes any quantity assumed as one, or unity, to which the ratio of the other homogeneous or similar quantities is expressed.

MEASURE, in a legal and commercial sense, denotes a certain quantity or proportion of any thing, bought, sold, valued, or the like.

It is necessary, for the convenience of commerce, that an uniformity should be observed in weights and measures, and regulated by proper standards. A foot-rule may be used as a standard for measures of length, a bushel for measures of capacity, and a pound for weights. There should be only one authentic standard of each kind, formed of the most durable materials, and kept with all possible care. A sufficient number of copies, exactly corresponding to the principal standard, may be distributed for adjusting the weights and measures that are made for common use. There are several standards of this kind both in England and Scotland. See the article *WEIGHTS and Measures*.

If any one of the standards above-mentioned be justly preserved, it will serve as a foundation for the others, by which they may be corrected if inaccurate, or restored if entirely lost. For instance, if we have a standard foot, we can easily obtain an inch, and can make a box which shall contain a cubical inch, and may serve as a standard for measures of capacity. If it be known that a pint contains 100 cubical inches, we may make a vessel five inches square, and four inches deep, which will contain a pint. If the standard be required in any other form, we may fill this vessel with water, and regulate another to contain an equal quantity. Standards for weights may be obtained from the same foundation; for if we know how many inches of water it takes to weigh a pound, we have only to measure that quantity, and the weight which balances it may be assumed as the standard of a pound.

Again, if the standard of a pound be given, the measure of an inch may be obtained from it: for we may weigh a cubical inch of water, and pour it into a regular vessel; and having noticed how far it is filled, we may make another vessel of like capacity in the form of a cube. The side of this vessel may be assumed as the standard for an inch; and standards for a foot, a pint, or a bushel, may be obtained from it. Water is the most proper substance for regulating standards; for all other bodies differ in weight from others of the same kind; whereas it is found by experience that spring and river water, rain, and melted

snow, and all other kinds, have the same weight; and this uniformly holds in all countries where the water is pure, alike warm, and free from salt and minerals.

Thus, any one standard is sufficient for restoring all the rest. It may further be desired to hit on some expedient, if possible, for restoring the standards, in case that all of them should ever fall into disorder, or should be forgotten, through the length of time, and the vicissitudes of human affairs. This seems difficult, as no words can convey a precise idea of a foot-rule, or a pound weight. Measures, assumed from the dimensions of the human body, as a foot, a hand-breadth, or a pace, must nearly be the same in all ages, unless the size of the human race undergo some change; and therefore, if we know how many square feet a Roman acre contained, we may form some judgment of the nature of the law which restricted the property of a Roman citizen to seven acres; and this is sufficient to render history intelligible; but it is too inaccurate to regulate measures for commercial purposes. The same may be said of standards, deduced from the measure of a barley-corn, or the weight of a grain of wheat. If the distance of two mountains be accurately measured and recorded, the nature of the measure used will be preserved in a more permanent manner than by any standard; for if ever that measure fall into disuse and another be substituted in its place, the distance may be measured again, and the proportion of the standards may be ascertained by comparing the new and ancient distances.

But the most accurate and unchangeable manner of establishing standards is, by comparing them with the length of pendulums. The longer a pendulum is, it vibrates the slower; and it must have one precise length in order to vibrate in a second. The slightest difference in length will occasion a difference in the time; which will become abundantly sensible after a number of vibrations, and will be easily observed if the pendulum be applied to regulate the motion of a clock. The length of a pendulum which vibrates seconds in London is about 39½ inches, is constantly the same at the same place; but it varies a little with the latitude of the place, being shorter as the latitude is less. Therefore, though all standards of weights and measures were lost, the length of a second pendulum might be found by repeated trials: and if the pendulum be properly divided, the just measure of an inch will be obtained; and from this all other standards may be restored. See *Whitehurst on Invariable Measures*.

Measures are various, according to the various kinds and dimensions of the things measured.—Hence arise lineal or longitudinal measures, for lines or lengths; square measures, for areas or superficies; and solid or cubic measures, for bodies and their capacities: all which again are very different in different countries and in different ages, and even many of them for different commodities. Whence arise other divisions of ancient and modern measures, domestic and foreign ones, dry measures, liquid measures, &c.

I. *Long Measures, or Measures of Application.*

1.] *The English and Scotch Standards.*

The English lineal standard is the yard, containing 3 English feet; equal to 3 Paris feet 1 inch and ⅔.

of an inch, or $\frac{2}{3}$ of a Paris ell. The use of this measure was established by Henry I. of England, and the standard taken from the length of his own arm. It is divided into 36 inches, and each inch is supposed equal to 3 barley-corns. When used for measuring cloth, it is divided into four quarters, and each quarter subdivided into 4 nails. The English ell is equal to a yard and a quarter, or 45 inches, and is used in measuring linens imported from Germany and the Low-Countries.

The Scots *elwand* was established by king David I. and divided into 37 inches. The standard is kept in the council-chamber of Edinburgh, and being compared with the English yard, is found to measure $37\frac{1}{2}$ inches; and therefore the Scots inch and foot are larger than the English, in the proportion of 180 to 185; but this difference being so inconsiderable, is seldom attended to in practice. The Scots ell, though forbidden by law, is still used for measuring some coarse commodities, and is the foundation of the land-measure of Scotland.

Itinerary measure is the same both in England and Scotland. The length of the chain is 4 poles, or 22 yards; 80 chains make a mile. The old Scots computed miles were generally about a mile and a half each.

The reel for yarn is $2\frac{1}{2}$ yards, or 10 quarters, in circuit; 120 threads make a cut, 12 cuts make a hank or hank, and 4 hanks make a spindle.

2.] The French Standard is the aune or ell, containing 3 Paris feet 7 inches 8 lines, or 1 yard $\frac{1}{4}$ English; the Paris foot royal exceeding the English by $\frac{63}{100}$ parts, as in one of the following tables. This ell is divided two ways, viz. into halves, thirds, sixths, and twelfths; and into quarters, half-quarters, and sixteenths.

This ell holds throughout the greatest part of France; excepting at Troyes in Champagne, at Arc in the Barrois, and in some parts of Picardy and Burgundy, where the ell contains only 2 feet 5 inches 1 line; in Bretagne, where it contains 4 feet 2 inches 11 lines; and at St Genoux in Berry, where it exceeds the Paris ell by 8 lines. See ELL. But in Languedoc, particularly at Marfeilles, Montpellier, Thoulouse in Provence, and in Guienne, they measure by the canna, which at Thoulouse and in Guienne contains 5 Paris feet 5 inches and 6 lines; or one Paris ell and a half. But at Montpellier, and throughout the Lower Languedoc, as also in Provence and Avignon, and even Dauphine, the canna is 6 feet and 9 lines, or 1 Paris ell and $\frac{3}{4}$. See CANNA.

We have lately had some accurate comparisons between some of the French weights and measures and those of England, the result of which is, (1.) The Paris half toise, as set off on the standard kept in the Royal Society; contains of English inches by the same standard 38.355, whence it appears, that the English yard and foot is, to the Paris half toise and foot, nearly as 107 to 114; for as 107 to 114, so is 36 to 38.35514.

(2.) The Paris 2 marc, or 16 ounce weight, weighs English Troy grains 7560; whence it appears, that the English Troy pound of 12 ounces, or 5760 grains, is to the Paris 2 marc, or 16 ounce weight, as 16 to 21; that the Paris ounce weighs English Troy grains

472.5, and that consequently, the English Troy ounce is to the Paris ounce as 64 is to 63.

(3.) The English Avoirdupois pound weighs Troy grains 7004; whence the Avoirdupois ounce, whereof 16 make a pound, is found equal to 437.75 Troy grains.—And it follows, that the Troy pound is to the Avoirdupois pound as 88 to 107 nearly; for as 88 to 107, so is 5760 to 7003.636; that the Troy ounce is to the Avoirdupois ounce, as 80 to 73 nearly; for as 80 to 73, so is 480 to 438. And, lastly, that the Avoirdupois pound and ounce is to the Paris two marc weight and ounce, as 63 to 68 nearly; for as 63 to 68, so is 7004 to 7559.873. See WEIGHT.

(4.) The Paris foot expressed in decimals, is equal to 1.0654 of the English foot, or contains 12.785 English inches. See FOOT.

3.] The standard in Holland, Flanders, Sweden, a good part of Germany, many of the Hans-towns, as Dantzick, and Hamburg, and at Geneva, Frankfort, &c. is likewise the ell: but the ell, in all these places, differs from the Paris ell. In Holland, it contains one Paris foot eleven lines, or four sevenths of the Paris ell. The Flanders ell contains two feet one inch five lines and half a line; or seven-twelfths of the Paris ell. The ell of Germany, Brabant, &c. is equal to that of Flanders.

4.] The Italian measure is the braccio, brace, or fathom. This obtains in the states of Modena, Venice, Florence, Lucca, Milan, Mantua, Bologna, &c. but is of different lengths. At Venice, it contains one Paris foot eleven inches three lines, or eight fifteenths of the Paris ell. At Boulogna, Modena, and Mantua, the brace is the same as at Venice. At Lucca it contains one Paris foot nine inches ten lines, or half a Paris ell. At Florence, it contains one foot nine inches four lines, or forty-nine hundredths of a Paris ell. At Milan, the brace for measuring of silks is one Paris foot seven inches four lines, or four-ninths of a Paris ell: that for woollen cloths is the same with the ell of Holland. Lastly, at Bergama, the brace is one foot seven inches six lines, or five-ninths of a Paris ell. The usual measure at Naples, however, is the canna, containing six feet ten inches and two lines, or one Paris ell and fifteen seventenths.

5.] The Spanisb measure is the vara or yard, in some places called the barra; containing seventeen twenty-fourths of the Paris ell. But the measure in Castile and Valencia is the pan. span, or palm; which is used, together with the canna, at Genoa. In Aragon, the vara is equal to a Paris ell and a half, or five feet five inches six lines.

6.] The Portuguese measure is the cavedos, containing two feet, eleven lines, or four-sevenths of a Paris ell; and the varra, a hundred and six whereof make a hundred Paris ells.

7.] The Piedmontese measure is the ras, containing one Paris foot nine inches ten lines, or half a Paris ell. In Siçily, their measure is the canna, the same with that of Naples.

8.] The Muscovite measures are the cubit, equal to one Paris foot four inches two lines; and the arin, two whereof are equal to three cubits.

9.] The Turkish and Levant measures are the picq, containing two feet two inches and two lines, or three fifths of the Paris ell. The Chinese measure, the

cobre;

Measure. cobre; ten whereof are equal to three Paris ells. In Persia, and some parts of the Indies, the guezze, whereof there are two kinds; the royal guezze, called also the *guezze monkeffer*, containing two Paris feet ten inches eleven lines, or four-fifths of the Paris ell; and the shorter guezze, called simply *guezze*, only two thirds of the former. At Goa and Oimuz, the measure is the vara, the same with that of the Portuguese, having been introduced by them. In Pegu, and some other parts of the Indies, the cando or candi, equal to

the ell of Venice. At Goa, and other parts, they use a larger cando, equal to seventeen Dutch ells; exceeding that of Babel and Balfora by $\frac{7}{8}$ per centum, and the vera by 64. In Siam, they use the ken, short of three Paris feet by one inch. The ken contains two foks, the fok two keubs, the keub twelve nious or inches, the niou to be equal to eight grains of rice, i. e. to about nine lines. At Cambioa, they use the hafter; in Japan, the tatam; and the span on some of the coasts of Guinea.

TABLES of LONG Measure.

I ENGLISH.

Barley-corn			ENGLISH.										
3	Inch												
9	3	Palm											
27	9	3	Span										
36	12	4	1½	Foot									
54	18	6	2	1½	Cubit								
108	36	12	4	3	2	Yard							
180	60	20	6½	5	3½	1½	Pace						
216	72	24	8	6	4	2	1½	Fathom					
594	198	66	22	16½	11	5½	3⅞	2½	Pole				
23760	7920	2640	880	660	440	220	132	110	40	Furlong			
190080	63360	21120	7040	5280	3520	1760	1056	880	320	8	1	1	1

2. *SCRIPTURE Measures reduced into English.*

2. SCRIPTURE Measures reduced into English.										Eng. feet.	Eng. Dec							
Digit										o	0.912							
4	Palm										o	3.648						
12	3	Span										o	10.944					
24	6	2	Cubit										1	9.888				
96	24	8	4	Fathom										7	3.552			
144	36	12	6	1½	Ezechiel's reed										10	11.328		
192	48	16	8	2	1½	Arabian pole										14	7.104	
1920	480	160	80	20	13½	10	Schoenus, or measuring line										145	11.04

3. *The SCRIPTURE Itinerary Measures.*

Cubit						Eng. Miles.		Paces.	Feet.
							0	0	1.824
400	Stadium						0	145	46
2000	5	Sab. day's journey					0	729	3.000
4000	10	2 Eastern mile					1	403	1.000
12000	30	6 3 Parafan					4	153	3.000
96000	240	48 24 8	a day's journey				33	172	4.000

4. GRECIAN.										Paces, feet.	dec.
Dactylus, digit										0 0	0.7554 $\frac{1}{2}$
4 Doron, dochme										0 0	3.0218 $\frac{1}{2}$
10 2 $\frac{1}{2}$ Lichas										0 0	7.5546 $\frac{1}{8}$
11 2 $\frac{1}{2}$ 1 $\frac{1}{10}$ Orthodoron										0 0	8.3101 $\frac{1}{8}$
12 3 1 $\frac{1}{2}$ 1 $\frac{1}{10}$ Spithame										0 0	9.0656 $\frac{1}{2}$
16 4 1 $\frac{6}{10}$ 1 $\frac{1}{5}$ 1 $\frac{1}{10}$ Foot										0 1	0.0875
18 4 $\frac{1}{2}$ 1 $\frac{4}{5}$ 1 $\frac{1}{5}$ 1 $\frac{1}{10}$ 1 $\frac{1}{10}$ Cubit										0 1	1.5984 $\frac{1}{8}$
20 5 2 1 $\frac{9}{10}$ 1 $\frac{1}{2}$ 1 $\frac{1}{2}$ 1 $\frac{1}{10}$ Pygon										0 1	3.109 $\frac{1}{2}$
24 6 2 $\frac{3}{4}$ 2 $\frac{2}{3}$ 2 1 $\frac{1}{2}$ 1 $\frac{1}{2}$ 1 $\frac{1}{10}$ Cubit larger										0 1	6.13125
96 24 9 $\frac{1}{2}$ 8 $\frac{3}{4}$ 8 6 5 $\frac{1}{2}$ 4 $\frac{1}{2}$ 4 Pace										0 6	0.525
9600 2400 960 872 $\frac{1}{2}$ 800 600 533 $\frac{1}{3}$ 480 400 100 Furlong										100 4	4.5
76800 19200 7680 6981 $\frac{1}{2}$ 6400 6800 4266 $\frac{1}{2}$ 3840 3200 800 8 Mile										805 5	0

5. ROMAN.										Paces, feet.	dec.
Digitus transversus										0 0	0.725 $\frac{1}{2}$
1 $\frac{1}{2}$ Uncia										0 0	0.967
4 3 Palmus minor										0 0	2.901
16 12 4 Pes										0 0	11.604
20 15 5 1 $\frac{1}{2}$ Palmipes										0 1	2.505
24 18 6 1 $\frac{1}{2}$ 1 $\frac{1}{2}$ Cubitus										0 1	5.406
40 30 10 2 $\frac{1}{2}$ 2 1 $\frac{1}{2}$ Gradus										0 2	5.01
80 60 20 5 4 3 $\frac{1}{2}$ 2 Passus										0 4	10.02
10000 7500 2500 625 500 416 $\frac{1}{2}$ 250 125 Stadium										120 4	4.5
80000 60000 20000 5000 4000 3333 $\frac{1}{3}$ 2000 1000 8 Milliare										967 0	0

6. Proportions of several Long Measures to each other, by

M. Picard.

The Rhinland or Leyden foot (12 whereof make the Rhinland perch) supposed.

696

The English foot

675 $\frac{1}{2}$

The Paris foot

720

The Amsterdam foot, from that of Leyden, by Snellius

629

The Danish foot (two whereof make the Danish ell)

701 $\frac{8}{15}$

The Swedish foot

658 $\frac{1}{2}$

The Brussels foot

609 $\frac{1}{2}$

The Dantzic foot, from Hevelius's Selenographia

636

The Lyons foot, by M. Auzout

757 $\frac{1}{2}$

The Bologna foot, by the same

843

The braccio of Florence, by the same, and Father Merfenne

1290

The palm of the architects at Rome, according to the observations of Messrs Picard and Auzout

494 $\frac{1}{2}$

The Roman foot in the Capitol, examined by Messrs Picard and Auzout

653 or 653 $\frac{1}{2}$

The fane from the Greek foot

652

From the vineyard Mattei

657 $\frac{1}{2}$

From the palm

658 $\frac{1}{2}$

From the pavement of the pantheon, supposed to contain ten Roman feet

653

From a slip of marble in the same pavement, supposed to contain three Roman feet

650

From the pyramid of Cestius, supposed to contain 9 $\frac{1}{2}$ Roman feet653 $\frac{1}{2}$

from

M E A [717] M E A

Measure. From the diameters of the columns in the arch of Septimius Severus - - - 653 $\frac{1}{2}$

From a slip of porphyry in the pavement of the pantheon - - - 653 $\frac{1}{2}$

See on this subject Phil. Trans. Vol. L.L. art. 69. P. 774.

7. *Proportions of the Long Measures of several nations to the English foot, taken from Mr Greatvot, Auzout, Picard, and Eifenchmid. See Foot.*

The English standard foot being divided into 1000 equal parts, the other measures will have the proportions to it, which follow :

	Feet.	Inches.
English foot - - -	1000	12
Paris foot - - -	1068	12,816
Venetian foot - - -	1162	13,944
Rhinland foot - - -	1033	12,396
Strasburgh foot - - -	952	11,424
Norimbergh foot - - -	1000	12
Dantzick foot - - -	944	11,328
Danish foot - - -	1042	12,504
Swedish foot - - -	977 $\frac{1}{2}$	11,733
Derahor cubit of Cairo - - -	1824	21,888
Perfian arish - - -	3197	38,364
Greater Turkish pike - - -	2200	26,4
Lesser Turkish pike - - -	2131	25,572
Braccio at Florence - - -	1913	22,956
Braccio for woollen at Siena - - -	1242	14,904
Braccio for linen at Siena - - -	1974	23,688
Canna at Naples - - -	6880	82,56
Vera at Almaria and Gibraltar - - -	2760	33,12
Palmo di Architeti at Rome - - -	732	87,84
Canna di Architeti - - -	7320	87,84
Palmo di braccio di mercantia - - -	695 $\frac{1}{2}$	8,346
Genoa palm - - -	815	9,78
Bolognian foot - - -	1250	15
Antwerp ell - - -	2283	27,396
Amsterdam ell - - -	2268	27,216
Leyden ell - - -	2260	27,12
Paris draper's ell - - -	3929	47,148
Paris mercer's ell - - -	3937	47,244

8. Different Itinerary Measures.

A French league is about 2 $\frac{1}{2}$ English miles
A German mile 4 ditto
A Dutch mile 3 $\frac{1}{2}$ ditto
An Italian mile 1 $\frac{1}{2}$ ditto
A Spanish league 3 $\frac{1}{2}$ ditto
A Russian verit 3 ditto

II. SQUARES, SUPERFICIAL, OF LAND MEASURE.

1.] *English* square measures are raised from the yard of 36 inches multiplied into itself, and thus producing 1296 square inches in the square yard; the divisions of this are square feet and inches; and the multiples, poles, roods, and acres. Because the length of a pole is 5 $\frac{1}{2}$ yards, the square of the same contains 30 $\frac{1}{4}$ square yards. A square mile contains 640 square acres. In measuring fens and woodlands, 18 feet are generally allowed to the pole, and 21 feet in forest lands.

A hide of land, frequently mentioned in the earlier part of the English history, contained about 100 arable acres; and 5 hides were esteemed a knight's fee. At

the time of the Norman conquest, there were 243,600 hides in England.

2.] *Scotch* square or land measure is regulated by the Scotch ell: 36 square ells = 1 fall, 40 falls = 1 rood, 4 roods = 1 acre.—The proportion between the Scotch and English acre, supposing the feet in both measures alike, is as 1369 to 1089, or nearly as 5 to 4. If the difference of the feet be regarded, the proportion is as 10,000 to 7869. The length of the chain for measuring land in Scotland is 24 ells, or 74 feet.—A husband-land contains 6 acres of fock and scythe land, that is, of land that may be tilled with a plough or mown with a scythe: 13 acres of arable land make one ox-gang, and 4 ox-gangs make a pound-land of old extent.

3.] *French* square measures are regulated by 12 square lines in the inch square; 12 inches in the foot, 22 feet in the perch, and 100 perches in the arpent, or acre.

TABLES of SQUARE MEASURE.

I. ENGLISH.

Inches	Feet	Yards	Paces	Poles	Rood	Acres
144	12	3	4	1		
1296	36	9	12	3		
3600	60	25	27	10.89		
39204	272 $\frac{1}{4}$	30 $\frac{1}{2}$	40	10.89		
1568160	10890	1210	435.6	40		
6272640	43560	4840	1743.6	160	4	1

2. *Grecian* square measures were the plethron or acre; by some said to contain 1444, by others 10,000 square feet; and aroura the half of the plethron. The aroura of the Egyptians was the square 100 cubits.

3. *Roman* square measure reduced to English. The integer was the jugerum or acre, which the Romans divided like the libra or as: thus the jugerum contained

	square feet.	square paces.	square rods.	square poles.	square feet.
As	28800	288	2	18	250.05
Deunx	26400	264	2	10	183.85
Dextans	24000	240	2	2	117.64
Dodrans	21600	216	1	3 $\frac{1}{4}$	51.4
Bes	19200	192	1	25	257.46
Septunx	16800	168	1	17	191.25
Semis	14400	144	1	9	125.05
Quincunx	12000	120	1	1	58.82
Triens	9600	96	0	32	264.85
Quadrans	7200	72	0	24	198.64
Sextans	4800	48	0	16	132.43
Uncia	2400	24	0	8	66.21

Note, A $\frac{1}{2}$ Actus major was 14,400 square feet, equal to a semis; clima, 3600 square feet, equal to a sextans; and actus minimus equal to a sextans.

III. CUBICAL Measures, or Measures of Capacity, for LIQUIDS.

1.] The *English* measures were originally raised from troy-weight : it being enacted by several statutes, that eight pounds troy of wheat, gathered from the middle of the ear, and well dried, should weigh a gallon of wine measure, the divisions and multiples whereof were to form the other measures ; at the same time it was also ordered, that there should be but one liquid measure in the kingdom : yet custom has prevailed, and there having been introduced a new weight, viz. the avoirdupois, we have now a second standard gallon adjusted thereto, and therefore exceeding the former in the proportion of the avoirdupois weight to troy weight. From this latter standard are raised two several measures, the one for ale, the other for beer. The sealed gallon at Guildhall, which is the standard for wines, spirits, oils, &c. is supposed to contain 231 cubic inches ; and on this supposition the other measures raised therefrom, will contain as in the table underneath : yet, by actual experiment, made in 1683, before the lord-mayor and the commissioners of excise, this gallon was found to contain only 224 cubic inches : it was however agreed to continue the common supposed contents of 231 cubic inches ; so that all computations stand on their old footing. Hence, as 12 is to 231, so is $14\frac{1}{2}$ to $281\frac{1}{2}$ the cubic inches in the ale-gallon : but in effect the ale-quart contains 704 cubic inches, on which principle the ale and beer gallon will be 282 cubic inches. The several divisions and multiples of these measures, and their proportions, are exhibited in the tables underneath.

The barrel for ale in London is 32 gallons, and the barrel for beer 36 gallons. In all other places of England, the barrel, both for ale and beer, is 34 gallons.

2.] *Scotch* liquid measure is founded on the pint. The Scotch pint was formerly regulated by a standard jug of cast metal, the custody of which was committed to the borough of Stirling. This jug was supposed to contain 105 cubic inches ; and though, after several careful trials, it has been found to contain only about 103 $\frac{1}{4}$ inches ; yet, in compliance with established custom, founded on that opinion, the pint *scopes* are still regulated to contain 105 inches, and the customary ale measures are about $\frac{1}{4}$ above that standard. It was enacted by James I. of Scotland, that the pint should contain 41 ounces Trone weight of the clear water of Tay, and by James VI. that it should contain 55 Scots Troy ounces of the clear water of Leith. This affords another method of regulating the pint, and also ascertains the ancient standard of the Trone weight. As the water of Tay and Leith are alike, the Trone weight must have been to the Scots Troy weight as 55 to 41 ; and therefore, the pound Trone must have contained about 21 $\frac{1}{4}$ ounces Scots Troy.

4 gills	= 1 mutchkin.
2 mutchkins	= 1 chopin.
2 chopins	= 1 pint.
2 pints	= 1 quart.
4 quarts	= 1 gallon.

* The Scotch quart contains 210 inches ; and is, therefore, about $\frac{1}{10}$ less than the English wine-gallon, and about $\frac{1}{4}$ less than the ale-gallon.

3.] As to the liquid measures of foreign nations, it is to be observed, that their several vessels for wine, vinegar, &c. have also various denominations according to their different sizes and the places wherein they are used. The woaders of Germany, for holding Rhenish and Moselle wines, are different in their gauges ; some containing 14 aumes of Amsterdamm measure, and others more or less. The aume is reckoned at Amsterdam for 8 steckans, or 20 verges, or for $\frac{1}{2}$ of a ton of 2 pipes ; or 4 barrels of French or Bourdeaux, which $\frac{1}{2}$ at this latter place is called *tierçon*, because 3 of them make a pipe or 2 barrels, and 6 the said ton. The steckan is 16 mingles, or 32 pints ; and the verge is, in respect of the said Rhenish and Moselle, and some other sorts of wine, 6 mingles ; but, in measuring brandy, it consists of 6 $\frac{1}{2}$ mingles. The aume is divided into 4 anckers, and the ancker into 2 steckans, or 32 mingles. The ancker is taken sometimes for $\frac{1}{4}$ of a ton, or 4 barrels ; on which footing the Bourdeaux-barrel ought to contain at Amsterdam (when the cask is made according to the just gauge) 124 steckans, or 200 mingles wine and lees ; or 12 steckans, or 192 mingles racked wine ; so that the Bourdeaux-ton of wine contains 50 steckans, or 800 mingles, wine and lees ; and 48 steckans, or 768 mingles of pure wine. The barrels or poignons of Nantes and other places on the river Loire, contain only 12 steckans Amsterdamm measure. The wine-ton of Rochelle, Cognac, Charente, and the Isle of Rhe, differs very little from the ton of Bourdeaux, and consequently from the barrels and pipes. A ton of wine of Chalosse, Bayonne, and the neighbouring places, is reckoned 60 steckans, and the barrel 15, Amsterdamm measure.

The muid of Paris contains 150 quarts, or 300 pints, wine and lees ; or 280 pints clear wine ; of which muids 3 make a ton, and the fractions are

The muid	} containing	36 setiers
The setier		4 quarts
The quart		2 pints
The pint		2 chopins
The chopin		2 demi-setiers
The demi-setier		2 poissons.

The muid is also composed of pipes, or poignons, quarteaux, queves, and demiqueves : those poignons of Paris and Orleans contain about 15 steckans Amsterdamm measure, and ought to weigh with the cask 666 lb. a little more or less. In Provence they reckon by milleroles, and the millerole of Toulon contains 66 Paris pints, or 100 pints of Amsterdamm, nearly ; and the Paris pint is nearly equal to the English wine-quart.

The butts or pipes from Cadiz, Malaga, Alicant, Benecarlo, Saloe, and Mataro, and from the Canaries, from Lisbon, Oporto, and Fayal, are very different in their gauges, though in asfreightments they are all reckoned two to the ton.

Vinegar is measured in the same manner as wine ; but the measures for brandies are different : these spirits from France, Spain, Portugal, &c. are generally shipped in large casks called *pipes*, *butts*, and *pieces* according to the places from whence they are reported, &c. In France, brandy is shipped in casks called *pieces* at Bourdeaux, and *pipes* at Rochelle, Cognac, the ile of Rhé, and other neighbouring places,

per barrel.

3. Attic

3. ARRIC reduced to English Wine-measure.

									Gal.	Pints.	Sol. inch.	Dec.
Cochliarion	-	-	-	-	-	-	-	-	0	$\frac{1}{128}$	0.0356 $\frac{1}{8}$	
2	Cheme	-	-	-	-	-	-	-	0	$\frac{1}{64}$	0.0712 $\frac{5}{8}$	
2 $\frac{1}{2}$	1 $\frac{1}{2}$ Myftron	-	-	-	-	-	-	-	0	$\frac{1}{32}$	0.0892 $\frac{1}{4}$	
5	2 $\frac{1}{2}$ 2 Conche	-	-	-	-	-	-	-	0	$\frac{1}{16}$	0.1784 $\frac{1}{2}$	
10	5 4 2 Cyathos	-	-	-	-	-	-	-	0	$\frac{1}{8}$	0.3561 $\frac{1}{4}$	
15	7 $\frac{1}{2}$ 6 3 1 $\frac{1}{2}$ Oxybaphon	-	-	-	-	-	-	-	0	$\frac{3}{8}$	0.535 $\frac{1}{8}$	
60	30 24 12 6 4 Cotyle	-	-	-	-	-	-	-	0	$\frac{1}{2}$	2.141 $\frac{1}{2}$	
120	60 48 24 12 8 2 Xestes	-	-	-	-	-	-	-	0	1	4.283	
720	360 288 144 72 48 12 6 Chous	-	-	-	-	-	-	-	0	6	25.698	
8640	4320 3456 1728 864 576 144 72 12 Metretres	-	-	-	-	-	-	-	10	2	19.629	

4. ROMAN reduced to English Wine-measure.

									Gal.	Pints.	Sol. inch.	Dec.
Ligula	-	-	-	-	-	-	-	-	0	$\frac{1}{48}$	0.1171 $\frac{1}{8}$	
4	Cyathus	-	-	-	-	-	-	-	0	$\frac{1}{12}$	0.469 $\frac{1}{4}$	
6	1 $\frac{1}{2}$ Acetabulum	-	-	-	-	-	-	-	0	$\frac{1}{8}$	0.704 $\frac{1}{2}$	
12	3 2 Quartarius	-	-	-	-	-	-	-	0	$\frac{1}{4}$	1.409	
24	6 4 2 Hemina	-	-	-	-	-	-	-	0	$\frac{1}{2}$	2.818	
48	12 8 4 2 Sextarius	-	-	-	-	-	-	-	0	1	5.636	
288	72 48 24 12 6 Congius	-	-	-	-	-	-	-	0	7	4.942	
1152	288 192 96 48 24 4 Urna	-	-	-	-	-	-	-	3	4 $\frac{1}{2}$	5.33	
2304	576 384 192 96 48 8 2 Amphora	-	-	-	-	-	-	-	7	1	10.66	
46080	11520 7680 3840 1920 960 160 40 20 Culeus	-	-	-	-	-	-	-	143	3	11.095	

IV. Measures of Capacity for things DRY.

1.] *English* dry or corn measure. The standard for measuring corn, salt, coals, and other dry goods, in England, is the Winchester gallon, which contains 272 $\frac{1}{2}$ cubic inches. The bushel contains 8 gallons, or 2178 inches. A cylindrical vessel, 18 $\frac{1}{2}$ inches diameter, and 8 inches deep, is appointed to be used as a bushel in levying the malt-tax. A vessel of these dimensions is rather less than the Winchester bushel of 8 gallons, for it contains only 2150 inches; though probably there was no difference intended. The denominations of dry measure commonly used, are given in the first of the subjoined tables. Four quarters corn make a chaldron, 5 quarters make a wey or load, and 10 quarters make a ton. In measuring sea-coal, 5 pecks

No 198.

make a bushel, 9 bushels make a quarter or vatt, 4 quarters make a chaldron, and 21 chaldrons make a score.

40 feet hewn timber make a load.
50 feet unhewn timber make a load.
32 gallons make a herring barrel.
42 gallons make a salmon barrel.
1 cwt. gun-powder makes a barrel.
256 lb. soap make a barrel.
10 dozen candles make a barrel.
12 barrels make a last.

2.] *Scotch* dry measure. There was formerly only one measure of capacity in Scotland; and some commodities were heaped, others *stroked*, or measured exactly to the capacity of the standard. The method of heaping was afterwards forbidden as unequal, and a larger

Measures. larger measure appointed for such commodities as that custom had been extended to.

The wheat-firiot, used also for rye, pease, beans, falt, and grafs-seeds, contains 21 pints 1 mutchkin, measured by the Stirling jug. The barley-firiot, used also for oats, fruit, and potatoes, contains 31 pints. A different method of regulating the firiot was appointed, from the dimensions of a cylindrical vessel. The diameter for both measures was fixed at 19½ inches, the depth 7½ inches for the wheat-firiot, and 10½ for the barley-firiot. A standard constructed by these measures is rather less than when regulated by the pint; and as it is difficult to make vessels exactly cylindrical, the regulation by the pint has prevailed, and the other method gone into disuse.

If the Stirling jug contain 103½ inches, the wheat-firiot will contain 2109 inches; which is more than 2 per cent. larger than the legal malt-bushel of England, and about 1 per cent. larger than the Winchester bushel: and the barley-firiot will contain 3208 inches. The barley-boll is nearly equal to fix legal malt bushels.

In Stirlingshire, 17 pecks are reckoned to the boll: in Invernesshire, 18 pecks: in Ayrshire, the boll is the same as the English quarter. And the firlots, in many places, are larger than the Linlithgow standard.

3.] *French dry*, are the litron, bushel, minot, mine, septier, muid, and tun. The litron is divided into two demilitrons, and four quarter-litrons, and contains 36 cubic inches of Paris. By ordonnance, the litron is to be three inches and a half high, and three inches 10 lines broad. The litron for falt is larger, and is divided into two halves, four quarters, eight demi-quarters, and 16 mesurettes. The French bushel is different in different jurisdictions. At Paris it is divided into demi-bushels; each demi-bushel into two quarts; the quart into two half-quarts; and the half-quart into two litrons: so that the bushel contains 16 litrons. By ordonnance the Paris bushel is to be eight inches two lines and a half high, and ten inches broad, or in diameter within-side. The minot consists of three bushels, the mine of two minots or six bushels, the septier of two mines or 12 bushels, and the muid of 12 septiers, or an 144 bushels. The bushel of oats is estimated double that of any other grain; so that there go 24 bushels to make the septier, and 288 to make the muid. It is divided into four picotins, the picotin containing two quarts, or four litrons. The bushel for falt is divided into two half-bushels, four quarters, eight half-quarters, and 16 litrons; four bushels make a minot, 16 a septier, and 192 a muid. The bushel for wood is divided into halves, quarters, and half-quarters. Eight bushels make the minot, 16 a mine; 20 mines, or 320 bushels, the muid. For plaister, 12 bushels make a sack, and 36 sacks a muid. For lime, three bushels make a minot, and 48 minots a muid. The minot is by ordonnance to be 11 inches 9 lines high, and 14 inches 8 lines in diameter. The minot is composed of three bushels, or 16 litrons; four minots make a septier, and 48 a muid. The French mine is no real vessel, but an estimation of several others. At Paris the mine contains fix bushels, and 24 make the muid; at Rouen the mine is four bushels; and at Dieppe, 18 mines make a Paris muid. The septier differs in different places: at Paris it contains two mines, or eight bushels, and 12 septiers the

muid. At Rouen the septier contains two mines or 12 bushels. Twelve septiers make a muid at Rouen as well as at Paris; but 12 of the latter are equal to 14 of the former. At Toulon the septier contains a mine and a half; three of which mines make the septier of Paris. The muid or mury of Paris consists of 12 septiers; and is divided into mines, minots, bushels, &c. That for oats is double that for other grain, *i. e.* contains twice the number of bushels. At Orleans the muid is divided into mines, but those mines only contain two Paris septiers and a half. In some places they use the tun in lieu of the muid; particularly at Nantes, where it contains 10 septiers of 16 bushels each, and weighs between 2200 and 2250 pounds. Three of these tuns make 28 Paris septiers. At Rochelle, &c. the tun contains 42 bushels, and weighs two per cent. less than that of Nantes. At Brest it contains 20 bushels, is equal to 10 Paris septiers, and weighs about 2240 pounds. See *TUN*.

4.] *Dutch, Swedish, Polish, Prussian, and Muscovite.*

In these places, they estimate their dry things on the foot of the *last, less, leb, or lecht*; so called according to the various pronunciations of the people who use it. In Holland, the last is equal to 19 Paris septiers, or 38 Bourdeaux bushels, and weighs about 4560 pounds; the last they divide into 27 mudes, and the mude into four scheepels. In Poland, the last is 40 Bourdeaux bushels, and weighs about 4800 Paris pounds. In Prussia, the last is 133 Paris septiers. In Sweden and Muscovy, they measure by the great and little last; the first containing 12 barrels, and the second half as many. See *LAST*. In Muscovy, they likewise use the chefford, which is different in various places: that of Archangel is equal to three Rouen bushels.

5.] *Italian.* At Venice, Leghorn, and Lucca, they estimate their dry things on the foot of the *staro* or *stajo*; the staro of Leghorn weighs 54 pounds: 112 staros and seven-eighths are equal to the Amsterdam last. At Lucca, 119 staros make the last of Amsterdam. The Venetian staro weighs 128 Paris pounds: the staro is divided into four quarters. Thirty-five staros and one-fifth, or 140 quarters and four-fifths, make the last of Amsterdam. At Naples and other parts, they use the *tomolo* or *tomalo*, equal to one-third of the Paris septier. Thirty-six *tomoli* and a half make the *carro*: and a *carro* and a half, or 54 *tomoli*, make the last of Amsterdam. At Palermo, 16 *tomoli* make the *salma*, and four *mondili* the *tomolo*. Ten *salmas* and three-sevenths, or 171 *tomoli* and three-sevenths, make the last of Amsterdam.

6.] *Flemish.* At Antwerp, &c. they measure by the *viertel*; 32 and one-half whereof make 19 Paris septiers. At Hamburg, the *scheepel*; 90 whereof make 19 Paris septiers.

7.] *Spanish and Portuguese.* At Cadiz, Bilbao, and St Sebastian, they use the *fanega*; 23 whereof make the Nantes or Rochelle tun, or nine Paris septiers and a half: though the Bilbao fanega is somewhat larger, inasmuch that 21 fanegas make a Nantes tun. At Seville, &c. they use the *anagoras*, containing a little more than the Paris mine; 36 *anagoras* make 19 Paris septiers. At Bayonne, &c. the *concha*; 30 whereof are equal to nine Paris septiers and an half. At Lisbon, the *alquiver*, a very small measure, 240 whereof make 19 Paris septiers, 60 the Lisbon muid.

TABLES of DRY MEASURE.

1. ENGLISH.

Solid inches				
33.6 Pint				
268.8	8	Gallon		
537.6	16	2	Peck	
2150.4	64	8	4	Bushel
17203.2	512	64	32	Quarter.

2. SCRIPTURE DRY, reduced to English.

Gachal					Peck.	Gal.	Pint.	Sol. inch.	Dec.
20	Cab				0	0	$0\frac{1}{16}$	0.031	
36	$1\frac{1}{2}$	Gomor			0	0	$2\frac{1}{8}$	0.073	
120	6	$3\frac{1}{2}$	Seah		1	0	1	1.211	
360	18	10	3	Epha	3	0	3	12.107	
1800	90	50	15	5	16	0	0	26.500	
3600	180	100	30	10	2	Chomer, or coron		18.969	

3. ATTIC Measures of Capacity for Things dry, reduced to English Corn Measure.

Cochliarion					Peck.	Gal.	Pint.	Sol. inch.	Dec.
10	Cyathos				0	0	0	$0.276\frac{1}{8}$	
15	$1\frac{1}{2}$	Oxybaphon			0	0	0	$2.763\frac{1}{2}$	
60	6	4	Cotyle		0	0	0	16.579	
120	12	8	2	Xestics	0	0	0	33.158	
180	18	12	3	$1\frac{1}{2}$	0	0	1	$15.705\frac{1}{2}$	
8640	864	576	144	72	4	8	Medimnos	3.501	

4. ROMAN Measures of Capacity for Things dry, reduced to English Corn Measure.

Ligula					Peck.	Gal.	Pint.	Sol. inch.	Dec.
4	Cyathus				0	0	$0\frac{1}{8}$	0.01	
6	$1\frac{1}{2}$	Acetabulum			0	0	$0\frac{1}{2}$	0.04	
24	6	4	Hemina		0	0	$8\frac{1}{2}$	0.24	
48	12	8	2	Sextarius	0	0	1	0.48	
384	96	64	16	8	Semimodius			3.84	
768	192	128	32	16	2	Modius		7.68	

Measure. *Measure of Wood for Airing*, is usually the cord; four feet high, and as many broad, and eight long; this is divided into two half-cords, called *ways*, and by the French *membrures*, from the pieces stuck upright to bound them; or *weyes*, as being supposed half a waggon-load.

Measure for Horses, is the hand, which by statute contains four inches.

MEASURE, among botanists. In describing the parts of plants, Tournefort introduced a geometrical scale, which many of his followers have retained. They measured every part of the plant; and the essence of the description consisted in an accurate mensuration of the whole.

As the parts of plants, however, are liable to variation in no circumstance so much as that of dimension, Linnæus very rarely admits any other mensuration than that arising from the respective length and breadth of the parts compared together. In cases that require actual mensuration, the same author recommends, in lieu of Tournefort's artificial scale, the following natural scale of the human body, which he thinks is much more convenient, and equally accurate.

The scale in question consists of 11 degrees, which are as follows: 1. A hair's-breadth, or the diameter of a hair, (*capillus*.) 2. A line, (*linea*), the breadth of the crescent or white appearance at the root of the finger, (not thumb), measured from the skin towards the body of the nail; a line is equal to 12 hair-breadths, and is the 12th part of a Parisian inch. 3. A nail, (*unguis*), the length of a finger-nail; equal to six lines, or half a Parisian inch. 4. A thumb, (*pollex*), the length of the first or outermost joint of the thumb; equal to a Parisian inch. 5. A palm, (*palmus*), the breadth of the palm exclusive of the thumb; equal to three Parisian inches. 6. A span, (*spithama*), the distance between the extremity of the thumb and that of the first finger when extended; equal to seven Parisian inches. 7. A great span, (*dodrans*), the distance between the extremity of the thumb and that of the little finger, when extended; equal to nine inches. 8. A foot, (*pes*), measuring from the elbow to the base of the thumb; equal to 12 Parisian inches. 9. A cubit, (*cubitus*), from the elbow to the extremity of the middle finger; equal to 17 inches. 10. An arm-length, (*brachium*), from the arm-pit to the extremity of the middle-finger; equal to 24 Parisian inches, or two feet. 11. A fathom, (*orgya*), the measure of the human stature; the distance between the extremities of the two middle fingers, when the arms are extended; equal, where greatest, to six feet.

MEASURE is also used to signify the cadence and time observed in poetry, dancing, and music, to render them regular and agreeable.

The different measures or metres in poetry, are the different manners of ordering and combining the quantities, or the long and short syllables. Thus, hexameter, pentameter, iambic, sapphic verses, &c. consist of different measures.

In English verses, the measures are extremely various and arbitrary, every poet being at liberty to introduce any new form that he pleases. The most usual are the heroic, generally consisting of five long and

five short syllables; and verses of four feet; and of three feet and a caesura, or single syllable.

The ancients, by variously combining and transposing their quantities, made a vast variety of different measures. Of words, or rather feet of two syllables, they formed a spondee, consisting of two long syllables; a pyrrhic, of two short syllables; a trochee, of a long and a short syllable; and an iambic, of a short and a long syllable.

Of their feet of three syllables they formed a molossus, consisting of three long syllables; a tibrach, of three short syllables; a dactyl, of one long and two short syllables; and an anapest, of two short and one long syllable. The Greek poets contrived 124 different combinations or measures, under as many different names, from feet of two syllables to those of six.

Measure in Music, the interval or space of time which the person who beats time, takes between the raising and falling of his hand or foot, in order to conduct the movement, sometimes quicker, and sometimes slower, according to the kind of music, or the subject that is sung or played.

The measure is that which regulates the time we are to dwell on each note. See **TIME**.

The ordinary or common measure is one second, or 60th part of a minute, which is nearly the space between the beats of the pulse or heart; the systole, or contraction of the heart, answering to the elevation of the hand; and its diastole, or dilatation, to the letting it fall. The measure usually takes up the space that a pendulum of two feet and an half long employs in making a swing or vibration. The measure is regulated according to the different quality or value of the notes in the piece; by which the time that each note is to take up is expressed. The semibreve, for instance, holds one rise, and one fall; and this is called the *measure*, or *whole measure*; sometimes the *measure-note*, or *time-note*; the minim, one rise, or one fall; and the crotchet, half a rise, or half a fall, there being four crotchets in a full measure.

MEASURE Binary or Double, is that wherein the rise and fall of the hand are equal.

MEASURE Ternary or Triple, is that wherein the fall is double to the rise; or where two minims are played during a fall, and but one in the rise. To this purpose, the number 3 is placed at the beginning of the lines, when the measure is intended to be triple; and a C, when the measure is to be common or double. This rising and falling of the hands was called by the Greeks *ἀνακ* and *κατακ*. St Augustine calls it *plausus*, and the Spaniards *compas*. See **ARMS** and **THESES**.

Powder MEASURES in Artillery, are made of copper, and contain from an ounce to 12 pounds: these are very convenient in a siege, when guns or mortars are loaded with loose powder, especially in ricochet firing, &c.

MEASURING, or **MENSURATION**, is the using a certain known measure, and determining thereby the precise extent, quantity, or capacity of any thing.

MEASURING, in the general, makes the practical part of geometry. From the various subjects whereon

Meat.

it is employed, it acquires various names, and constitutes various arts. See GEOMETRY, LEVELLING, TRIGONOMETRY, &c.

MEAT. See FOOD, DIET, DRINK, &c.

Amongst the Jews, several kinds of animals were forbidden to be used as food. The flesh with the blood, and the blood without the flesh, were prohibited; the fat also of sacrificed animals was not to be eaten. Roast meat, boiled meat, and ragouts, were in use amongst the Hebrews, but we meet with no kind of seasoning except salt, bitter herbs, and honey.—They never mingled milk in any ragout or hash, and never eat at the same meal both meat and milk, butter or cheese. The daily provision for Solomon's table was 30 measures of fine wheat flour, 60 of common flour, 20 stalls of oxen, 20 pasture oxen, 100 sheep, besides venison and wild-fowl. See LUXURY.

The principal and most necessary food amongst the ancient Greeks was bread, which they called *αἶσχος*, and produced in a wicker basket called *καστός*. Their loaves were sometimes baked under the ashes, and sometimes in an oven. They also used a sort of bread called *Μαζα*. Barley meal was used amongst the Greeks, which they called *αγρίον*. They had a frequent dish called *ἄσπερον*, which was a composition of rice, cheese, eggs, and honey, wrapped in fig-leaves. The *Μυρραίνιον* was made of cheese, garlic, and eggs, beaten and mixed together. Their bread, and other substitutes for bread, were baked in the form of hollow plates, into which they poured a sauce. Garlic, onions, and figs, seem to have been a very common food amongst the poorer Athenians. The Greeks, especially in the heroic times, ate flesh roasted; boiled meat seldom was used. Fish seems not to have been used for food in the early ages of Greece. The young people only, amongst the Lacedemonians, ate animal food; the men and the old men were supported by a black soup called *μυρραίνιον*, which to people of other nations was always a disagreeable mess. Grass-hoppers and the extremities or tender shoots of trees were frequently eaten by the poor among the Greeks. Eels dressed with beet root was esteemed a delicate dish, and they were fond of the jowl and belly of salt-fish. Neither were they without their sweet-meats: the desert consisted frequently of fruits, almonds, nuts, figs, peaches, &c. In every kind of food we find salt to have been used.

The diet of the first Romans consisted wholly of milk, herbs, and roots, which they cultivated and dressed with their own hands; they also had a kind of gruel, or coarse gross papp, composed of meal and boiling water; this served for bread: And when they began to use bread, they had none for a great while but of unmixed rye. Barley-meal was eaten by them, which they called *Polenta*. When they began to eat animal food, it was esteemed a piece of luxury, and an indulgence not to be justified but by some particular occasion. After animal food had grown into common use, the meat which they most frequently produced upon their tables was pork.

Method of Preserving Flesh-Meat without Spices, and with very little Salt. Jones, in his *Miscellanea Curiosa*, gives us the following description of the Moorish *Eleballe*, which is made of beef, mutton, or camel's flesh, but chiefly beef, and which they cut

Meath.

all in long slices, and let it lie for 24 hours in a pickle. They then remove it out of those jars or tubs into others with water, and when it has lain a night, they take it out, and put it on ropes in the sun and air to dry. When it is thoroughly dried and hard, they cut it into pieces of two or three inches long, and throw it into a pan or caldron, which is ready with boiling oil and fuel sufficient to hold it, where it boils till it be very clear and red when cut. After this they take it out, and set it to drain; and when all is thus done it stands to cool, and jars are prepared to put it up in, pouring upon it the liquor in which it was fried; and as soon as it is thoroughly cold, they stop it up close. It will keep two years; will be hard, and the hardest they look upon to be the best done. This they dish up cold, sometimes fried with eggs and garlic, sometimes stewed, and lemon squeezed on it. It is very good any way, either hot or cold.

MEATH, commonly so called, or otherwise *Eaſt Meath*, to diſtinguiſh it from the county called *West Meath*: A county of Ireland, in the province of Leister, bounded by the counties of Cavan and Louth on the north, the Irish channel on the east, Kildare and Dublin on the south, and West Meath and Longford on the west. It is a fine champaign country, abounding with corn, and well inhabited. It returns 14 members to parliament; and gives title of earl to the family of Brabazon. It contains 326,480 Irish plantation acres, 139 parishes, 12 baronies, and six boroughs; chief town Trim. This district being the most ancient settlement of the Belgians in Ireland, the inhabitants were esteemed the eldest and most honourable tribe: from which seniority their chieftains were elected monarchs of all the Belge; a dignity that was continued in the Hy-n-Faillian without intermission, until the arrival of the Caledonian colonies, under the name of Tuath de Danan, when Conor-Mor, chieftain of these people, obtained, or rather usurped, the monarchical throne, obliged Eochy Failloch, with several of his people, to cross the Shannon, and establish themselves in the present county of Roscommon, where Crothar founded the palace of Atha or Croghan, a circumstance which brought on a long and bloody war between the Belgian and Caledonian races, which was not finally terminated until the close of the 4th century, when the Belgian line was restored in the person of O'Nial the great, and continued until Briam Boromh usurped the monarchical dignity, by deposing Malachy O'Malachlin, about the year 1001. Tuathal Teththomar, by a decree of the Tarah assembly, separated certain large tracts of land from each of the four provinces, where the borders joined together; whence, under the notion of adopting this spot for demaine lands to support the royal household, he formed the county or kingdom of Meath, which afterwards became the peculiar inheritance of the monarchs of Ireland. In each of the portions thus separated from the four provinces, Tuathal caused palaces to be erected, which might adorn them, and commemorate the name in which they had been added to the royal domain. In the tract taken out of Munster, he built the palace called Flachtaga, where the sacred fire, so called, was kindled, and where all the priests and druids annually met on the last day of October; on the evening of which day it was enacted, that no other fire should

be used throughout the kingdom, in order that all the fires might be derived from this, which being lighted up as a fire of sacrifice, their superstition led them to believe would render all the rest propitious and holy; and for this privilege every family was to pay three-pence, by way of acknowledgment to the king of Munster. The second royal palace was erected in the proportion taken out of Connought, and was built for the assembly called the convocation of Vifneach, at which all the inhabitants were summoned to appear on the 1st day of May, to offer sacrifice to *Beal*, or *Bel*, the god of fire, in whose honour two large fires being kindled, the natives used to drive their cattle between them, which was supposed to be a preservative for them against accidents and distempers, and this was called *Beal-Tinne*, or *Bel-Tinne*, or the festival of the god of fire. The king of Connought at this meeting claimed a horse and arms from every lord of a manor or chieftain, as an acknowledgement for the lands taken from that province, to add to the territory of Meath. The third was that which Taittean erected in the part taken from Ulster, where the fair of that name was held, which was remarkable for this particular circumstance, that the inhabitants brought their children thither, males and females, and contracted them in marriage, where the parents having agreed upon articles, the young people were joined accordingly; every couple contracted at this meeting, paid the king of Ulster an ounce of silver by way of acknowledgement. The royal mansion of Tarah, formerly destroyed by fire, being re-built by Tuathal, on the lands originally belonging to the king of Leinster, was reckoned as the fourth of these palaces; but as a fabric of that name had stood there before, we do not find that any acknowledgment was made for it to the king of Leinster.

Meath, with *Clonmacnois*, is a bishop's see, valued in the king's books at L. 373 : 7 : 04, Sterling, by an extent returned anno 28th Elizabeth; but, by a former extent taken anno 30th Henry VIII. the valuation amounts to L. 373, 12s. which being the largest and most profitable for the king, is the measure of the first fruits at this day. This see is reputed to be worth annually L. 3400. There were formerly many Episcopal sees in Meath, as Clonard, Duleek, Kells, Trim, Ardbraccan, Dounaghlin, Slaine, and Foure, besides others of less note; all these, except Duleek and Kells, were consolidated, and their common see was fixed at Clonard, before the year 1152; at which time the divisions of the bishoprics in Ireland was made by John Paparo, cardinal-priest, entitled cardinal of St Lawrence in Damaso, then legate from Pope Eugene III. to the Irish. This division was made in a Synod held on the 6th of March in the abbey of Mellifont, or, as some say, at Kells; and the two sees of Duleek and Kells afterwards submitted to the same fate. The constitution of this diocese is singular, having no dean nor chapter, cathedral, or economy.—Under the bishop, the archdeacon is the head officer, to whom, and to the clergy in general, the *consé d'élire* issued while bishops were elective. The affairs of the diocese are transacted by a synod, in the nature of a chapter, who have a common seal, which is annually lodged in the hands of one of the body, by the ap-

pointment and vote of the majority. The diocese is divided into twelve rural deaneries.

Of Clonmacnois, now annexed to Meath: There is no valuation of this see in the king's books; but it is supposed to be included in the extent of the fee of Meath, taken anno 30th Henry VIII. The chapter of this see consisted anciently of dean, chanter, chancellor, treasurer, archdeacon, and twelve prebendaries, but most of the possessions of them have fallen into lay-hands. At present the deanery is the only part of the chapter which subsists, to which the prebend of Cloughran is annexed, and he hath a seal of office, which appears to have been the ancient Episcopal seal of this see. This fee was founded by St Kiaran, or Ciaran, the younger, in 543 or 549; and Dermody, the son of Ceronill, king of Ireland, granted the site on which the church was built.

West Meath. See WESTMEATH.

MEATUS AUDITORIUS. See ANATOMY, n^o 139.

MEAUX, an ancient town of France, in Brie, with a bishop's see, seated in a place abounding in corn and cattle, on the river Marne, which divides it into two parts, and its trade consists in corn, wool, and cheese. E. Long. 2. 58. N. Lat. 48. 58.

MECENAS, or MECENAS (C. Cilnius), a celebrated Roman knight, descended from the kings of Etruria. He has rendered himself immortal by his liberal patronage of learned men and of letters; and to his prudence and advice Augustus acknowledged himself indebted for the security he enjoyed. His fondness for pleasure removed him from the reach of ambition; and he preferred dying, as he was born, a Roman knight, to all the honours and dignities which either the friendship of Augustus or his own popularity could heap upon him. To the interference of Mecenas, Virgil owed the retribution of his lands; and Horace was proud to boast that his learned friend had obtained his forgiveness from the emperor, for joining the cause of Brutus at the battle of Philippi. Mecenas was himself fond of literature; and, according to the most received opinion, he wrote a history of animals, a journal of the life of Augustus, a treatise on the different natures and kinds of precious stones, besides the two tragedies of Octavia and Prometheus, and other things, all now lost. He died eight years before Christ; and on his death-bed he particularly recommended his poetical friend Horace to the care and confidence of Augustus. Seneca, who has liberally commended the genius and abilities of Mecenas, has not withheld his censure from his dissipation, indolence, and effeminate luxury. From the patronage and encouragement which the princes of heroic and lyric poetry among the Latins received from the favourite of Augustus, all patrons of literature have ever since been called *Mecenates*. Virgil dedicated to him his Georgics, and Horace his odes.

MECCA, an ancient and very famous town of Asia, in Arabia the Happy; seated on a barren spot, in a valley surrounded with little hills, about a day's journey from the Red-Sea. It is a place of no strength, having neither walls, nor gates, and the buildings are very mean. That which supports it is the resort of a great many thousand pilgrims annually, for the shops are scarcely open all the year besides. The inhabitants

Meath
Mecca.

Mecca.

are poor, very thin, lean, and swarthy. The hills about the town are very numerous; and consist of a blackish rock, some of them half a mile in circumference. On the top of one of them is a cave, where they pretend Mahomet usually retired to perform his devotions, and hither they affirm the greatest part of the Alcoran was brought him by the angel Gabriel. The town has plenty of water, and yet little garden-stuff; but there are several sorts of good fruits to be had, such as grapes, melons, water-melons, and cucumbers. There are also plenty of sheep brought thither to be sold to the pilgrims. It stands in a very hot climate; and the inhabitants usually sleep on the tops of their houses for the sake of coolness. In order to protect themselves from the heat through the day, they carefully shut the windows, and water the streets to refresh the air. There have been instances of persons suffocated in the middle of the town by the burning wind called *Simoom*.

As a great number of the people of distinction in the province of Hedsjas stay in the city, it is better built than any other in Arabia. Amongst the beautiful edifices it contains, the most remarkable is the famous *Kaba*, or *Caaba*, "The house of God," which was held in great veneration by the Arabs even before Mahomet's time.

No Christian dare go to Mecca; not that the approach to it is prohibited by any express law, or that the sensible part of the Mahometans have any thing to object to it; but on account of the prejudices of the people, who, regarding this ground as sacred, think Christians unworthy of setting their foot on it; it would be profaned, in the opinion of the superstitious, if it was trod upon by infidels. The people even believe, that Christians are prevented from approaching by some supernatural power; and they tell the story of an infidel, who having got so far as the hills that surround Mecca, all the dogs of the city came out, and fell upon him; and who, being struck with this miracle, and the august appearance of the Kaba, immediately became a Mussulman. It is therefore to be presumed, that all the Europeans who describe Mecca as eye-witnesses, have been renegades escaped from Turkey. A recent example confirms this supposition. On the promise of being allowed to preserve his religion, a French surgeon was prevailed on to accompany the Emir Hadjsi to Mecca, in quality of physician; but at the very first station, he was forced to submit to circumcision, and then he was permitted to continue his journey.

Although the Mahometans do not allow Europeans to go to Mecca, they do not refuse to give them descriptions of the Kaba, and information with regard to that building; and there are persons who gain their bread by making designs and little pictures of the Kaba, and selling them to pilgrims. See *CAABA*.

The Mahometans have so high an opinion of the sanctity of Mecca, that they extend it to the places in the neighbourhood. The territory of that city is held sacred to certain distances, which are indicated by particular marks. Every caravan finds in its road a similar mark, which gives notice to the pilgrims when they are to put on the modest garb in which they must appear in those sacred regions. Every Mussulman is obliged to go once in his life, at least, to Mecca, to

perform his devotions there. If that law was rigorously enforced, the concourse of pilgrims would be prodigious, and the city would never be able to contain the multitudes from all the countries where the Mahometan religion prevails. We must, therefore, suppose, that devotees alone perform this duty, and that the others can easily dispense with it. Those whose circumstances do not permit a long absence, have the liberty of going to Mecca by a substitute.—A hired pilgrim, however, cannot go for more than one person at a time; and he must, to prevent frauds, bring an attestation in proper form, from an Imam of Mecca, that he has performed the requisite devotions on behalf of such a person, either alive or dead; for, after the decease of a person who has not obeyed the law during his life, he is still obliged to perform the journey by proxy.

The caravans, which are not numerous, when we consider the immense multitude of the faithful, are composed of many people who do not make the journey for purposes of devotion. These are merchant, who think they can transport their merchandizes with more safety, and dispose of them more easily; and contractors of every kind, who furnish the pilgrims, and the foldiers who escort the caravans, with necessities. Thus it happens, that many people have gone often to Mecca, solely from views of interest. The most considerable of those caravans is that of Syria, commanded by the Pacha of Damascus. It joins at some distance the second from Egypt, which is conducted by a Bey, who takes the title of Emir Hadjsi. One comes from Yemen, and another, less numerous, from the country of Lachsa. Some scattered pilgrims arrive by the Red Sea from the Indies, and from the Arabian establishments on the coasts of Africa. The Perians come in that which departs from Bagdad; the place of conductor to this last is bestowed by the Pacha, and is very lucrative, for he receives the ransoms of the heretical Perians.

It is of consequence to a pilgrim to arrive early at the holy places. Without having been present from the beginning at all the ceremonies, and without having performed every particular act of devotion, a man cannot acquire the title of Hadjsi: this is an honour very much coveted by the Turks, for it confers real advantages, and makes those who attain it to be much respected. Its infrequency, however, in the Mahometan dominions, shows how much the observation of the law commanding pilgrimages is neglected. A similar custom prevails among the Oriental Christians, who are also exceedingly emulous of the title of Hadjsi, or Mokdasi, which is given to pilgrims of their communion. In order to acquire this title, it is not sufficient that the person has made the journey to Jerusalem; he must also have kept the passover in that city, and have assisted at all the ceremonies of the holy weeks.

After all the essential ceremonies are over, the pilgrims next morning move to a place where they say Abraham went to offer up his son Isaac, which is about two or three miles from Mecca: here they pitch their tents, and then throw seven small stones against a little square stone building. This, as they affirm, is performed in defiance of the devil. Every one then purchases a sheep, which is brought for that purpose, eating

Mecca.

Mecca,
mechanics

eating some of it themselves, and giving the rest to the poor people who attend upon that occasion. Indeed these are miserable objects, and such starved creatures, that they seem ready to devour each other. After all, one would imagine that this was a very sanctified place; and yet a renegade who went in pilgrimage thither, affirms there is as much debauchery practised here as in any part of the Turkish dominions. It is 25 miles from Jodda, the sea-port town of Mecca, and 220 south-east of Medina. E. Long. 40. 55. N. Lat. 21. 45.

MECHANICAL, an epithet applied to whatever relates to mechanics: thus we say, mechanical powers, causes, &c. See the articles **POWER**, **CAUSE**, &c.

The mechanical philosophy is the same with what is otherwise called *corpuscular philosophy*. See **CORPUSCULAR**.

This manner of reasoning is much used in medicine; and, according to Dr Quincy, is the result of a thorough acquaintance with the structure of animal bodies: for considering an animal body as a composition out of the same manner from which all other bodies are formed, and to have all those properties which concern a physician's regard, only by virtue of its peculiar construction; it naturally leads a person to consider the several parts, according to their figures, contexture,

and use, either as wheels, pulleys, wedges, levers, screws, cords, canals, strainers, &c. For which purpose, continues he, it is frequently found helpful to design in diagrams, whatsoever of that kind is under consideration, as is customary in geometrical demonstrations.

For the application of this doctrine to the human body, see the article **MEDICINE**.

MECHANICAL, in mathematics, denotes a construction of some problem, by the assistance of instruments, as the duplicature of the cube and quadrature of the circle, in contradistinction to that which is done in an accurate and geometrical manner.

MECHANICAL CURVE, is a curve, according to Descartes, which cannot be defined by any algebraic equation; and so stands contradistinguished from algebraic or geometrical curves.

Leibnitz and others call these mechanical curves *transcendental*, and dissent from Descartes, in excluding them out of geometry. Leibnitz found a new kind of transcendental equations, whereby these curves are defined: but they do not continue constantly the same in all points of the curve, as algebraic ones do. See the article **TRANSCENDENTAL**.

Mecca,
Mechanics.

M E C H A N I C S,

IN the strict sense of the word, denotes the method of constructing machines to be set in motion, and to answer some useful purposes, by certain powers, either natural or artificial. According to this definition, the nature of the powers themselves is not the object of mechanical investigation, but rather the effect of them upon the passive bodies which we call *machines*; and the constructing of these in such a manner, that the powers may act upon them with the least possible obstruction, and produce the intended effect to the greatest advantage, is the perfection of **MECHANICS**.

It is usual, in treatises upon this subject, to begin with an investigation of the properties of *matter* itself, and of *central forces*; but the former is not to be investigated by mechanical means, and the latter belong so much to astronomy, that very little needs to be said upon them in this place; for which reason we refer to the articles **ASTRONOMY**, **MATTER**, and **MOTION**, for a discussion of these subjects. In treating of mechanics, therefore, we shall begin with a description of what are commonly called the *mechanic powers*; and afterwards consider the various ways in which they may be modified, in order to produce the effects expected from them.

SECT. I. Of Material or Mechanical Power in general.

§ 1. Production of Motion and Rest.

IN mechanics every thing is called a power which is capable of acting upon a solid body; and every power which can act upon matter is supposed to be material, without regarding any abstruse speculations concern-

ing its nature. Hence the force of gravity, of electricity, of fire, of air, of water, the power of animals, of bodies pressing or impinging with violence upon one another, are all accounted mechanical powers when applied to set machines in motion.

As any single power, when applied to a material body, will set it in motion in proportion to its quantity, so the action of an opposite power upon the same body produces rest. This may be easily conceived; for supposing two men to pull a log of wood with equal degrees of strength in directions exactly opposite to one another, the log will remain immovable. In like manner, if we put in a weight into one scale of a balance, motion will be produced; but rest is the certain consequence of counterpoising it with an equal weight in the opposite scale. When a weight is suspended freely in the air, we are apt to imagine that it is acted upon by no force whatever; but we will soon discover our mistake, by withdrawing the pressure of the air from one side; for the body then, instead of remaining at rest, will move with great violence to one side, and even contrary to the direction of gravity itself, unless it be extremely heavy. Whether rest be in all cases produced by the action of opposite powers upon the same substance, is a speculation to be discussed under the article **MOTION**.

§ 2. Of Resistance.

WHEN any moving power is stopped by a fixed obstacle, so that it can proceed no farther, we say that it is *resisted* by that obstacle. In this case we are apt to imagine that there is no force exerted by the resisting obstacle; but it is found by experience, that resistance is to all intents and purposes equivalent to a

Ultimate
causes of res-
istance.

Mechanical
Power.

power equal and contrary to that which is impelled against the resisting obstacle. This is exemplified in the case of a man standing in a boat, and pushing with a pole against the bank of a river or lake. In this case every one knows that the boat will go off in a direction contrary to that in which he pushes; but if the boat be fastened by means of a hook and rope to that part of the pole which is between the man's body and the bank, the boat will remain immovable by reason of the equality betwixt the action of the man upon the pole forward, and of the boat upon the same pole backward. Thus, in fig. 1. when the man pushes with the pole C against the bank D, in the direction CA, the boat B will be carried away from the bank in the direction AC; but if, by means of the rope E, the boat be fastened to the pole AC, the recoil of the boat in the direction AC will be just equal to the push given by the man in the direction CA, so that no motion will ensue let him exert ever so much strength. Hence we see, that by means of a resisting obstacle a power may be made to counteract itself, so that a motion or tendency to it may be produced in any direction; and in this case, as well as in the former, rest is produced by the opposition of two contrary forces.

Mate
CCLXXXII.

The very same effect would follow, though we should suppose the man in the boat not to push against the bank or any fixed obstacle, but against another boat fastened by means of a rope to his own. In this case both the boats will recede from each other till the rope be stretched; after which they will both remain immovable, unless they be acted upon by some power external to both. If both boats be at liberty, they will mutually recede from each other till they get beyond the reach of the pole.

Resistance
equivalent
to an oppos-
ing power.

Resistance, whatever we may speculate about it, seems ultimately to depend on the power of gravity joined with that of cohesion. Thus a weight of 100 pounds, even when suspended in the freest manner we can imagine, will resist much more than 20 pounds suspended in the same manner; and though hard bodies resist to a great degree, yet unless connected with some very heavy body, they are easily moved out of their place; and the immense gravitation of the whole globe of earth, we may justly suppose to be the source of all resistance whatever to mechanical powers.

On the whole, therefore, we may consider resistance as an active power; but the action of which is confined to a very limited space, or to the single point of contact; though several experiments tend to show, that even before actual contact bodies show a very perceptible degree of resistance.

§ 3. Of the Communication of Power.

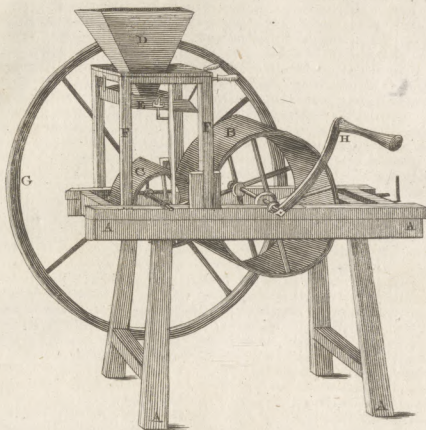
This depends entirely upon that property of bodies which is called their *attraction of cohesion*, and the immobility of their particles among themselves; for if the parts of a body are absolutely moveable among themselves, they can neither communicate motion by impulse nor by pressure. The most common method of communicating motion in the mechanical way is by pressure, which is generally accomplished by means of the six mechanical powers to be afterwards described: collision being employed only in certain particular

cases, the most remarkable of which will be pointed out under the article *MOTION*.

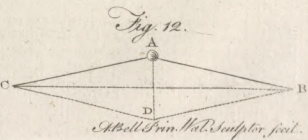
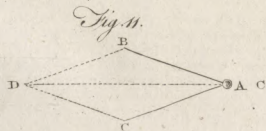
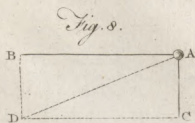
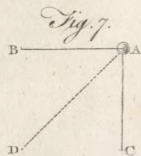
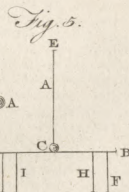
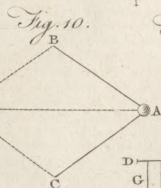
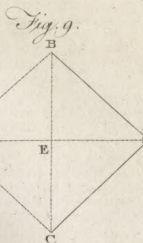
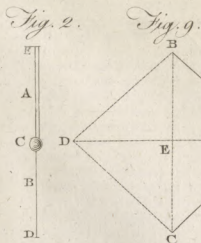
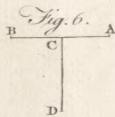
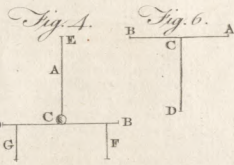
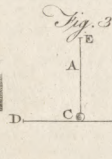
Mechanical
Power.

The motion, which by means of an hard inflexible body is communicated to any other, may be confined to a single point, or it may be diffused over any assignable space. Thus, in fig. 2. let us suppose that any assignable power is applied to the point E, urging it from E towards D; the whole of that force will rest upon the point of contact betwixt the ball C and the line BD. The weight, if placed exactly perpendicular to the horizon, will remain upright, without inclining either to one side or other; for the power of resistance in the line BD is exactly equal to the impulse of the weight lying upon E; so that it is in the same situation with the man and boat in the first example, when he had the boat hooked to the pole with which he pushed against the bank. If instead of opposing the end of the resisting body BD to the ball C, we place them in the position represented in fig. 3. then the whole of the power will rest upon any point of the line BD we please. For if we suppose the line EC to drive the line BD before it in the position represented in the figure, it is plain that the whole force of that line will be discharged for a moment upon the line F, or upon any obstacle we choose to put in its way in another part of the line; but if we place two supports or resistances to the moving line BD, as F and G in fig. 4. it is equally plain, that one half of the power will rest upon the one and one half upon the other. For the whole force urging forward the line BD is but a certain and determined quantity; and if divided betwixt two obstacles, each of these must undoubtedly bear one half. In like manner, if, as in fig. 5. the power be opposed by four obstacles, each of them will bear only one-fourth part; and so on if we suppose it opposed by ever so many. For reasons afterwards to be assigned, however, it is absolutely necessary that the force on E act in a line directly perpendicular upon BD; that the obstacles be all at equal distances, comparatively speaking, from C; as H and I, F and G, &c. likewise that they be of exactly the same height; for thus only the pressures, and consequently the motion, can be made uniform in all parts. On this principle depends in a great measure the perfection of printing presses, oil presses, and all other machines intended to produce a violent and uniform pressure upon any broad and flat surface.

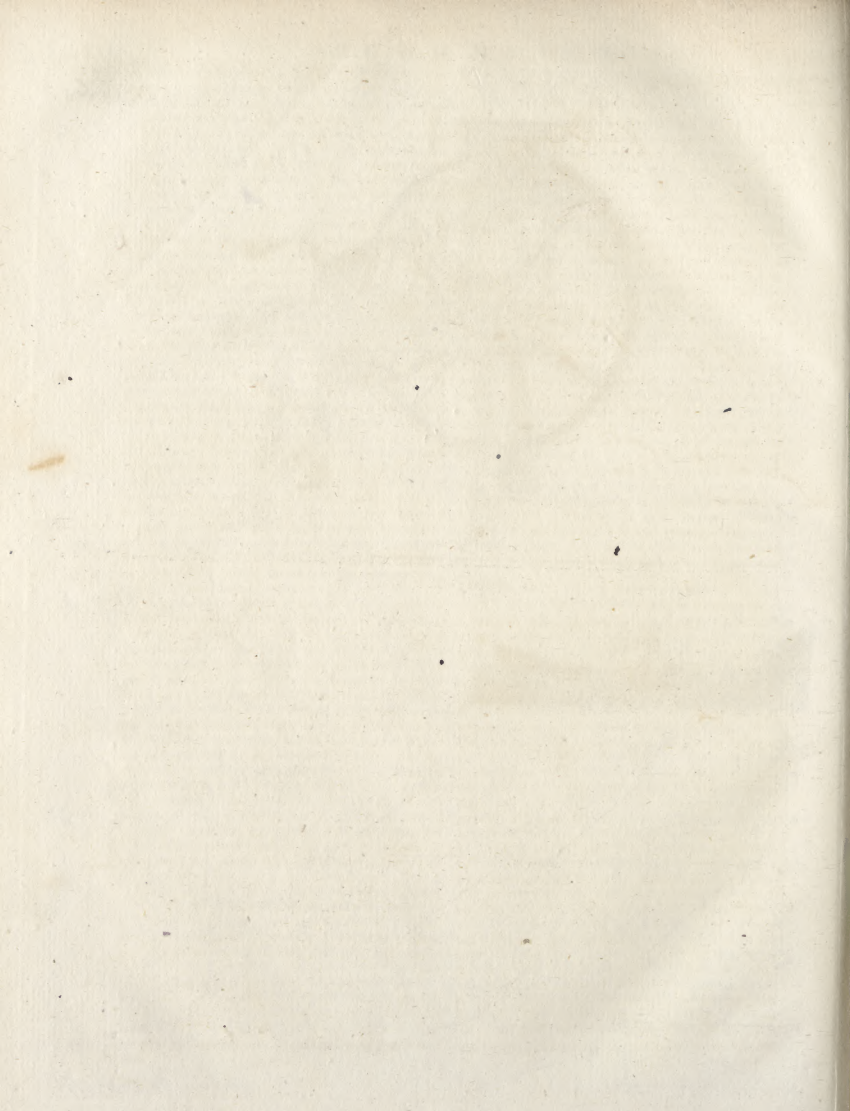
As the pressure upon a single point may thus be diffused over a broad surface, so may that upon a broad surface be concentrated upon a single point or a surface of small dimension, as in fig. 6. Here it is plain that whatever pressure is applied to the line AB, or any part of it in a perpendicular direction, must be sustained by the point D; for if there was no resistance, this point would be driven along with the line AB, and the moment it was stopped the power which urged it on must likewise be stopped. It is true, that unless the power act directly perpendicular to the point D, or the line CD be supported that it cannot move either to one side or to another, the impulse will be but momentary; but of this we shall treat at large in the subsequent part of this article. On the principle just mentioned depends in a great degree the force of gimlets, augers, boring gimlets, &c.



MECHANICS.



Atwell, Prin. & Co. Sculptors, fecit.



§ 4. Of changing the Direction of a Power into one directly opposite.

THIS in all cases is only to be accomplished by the application of a power greater than that of which we wish to change the direction. Thus, in fig. 2. suppose we wish to change the direction of the power at E from the direction AC to that of CA, we will find it impossible to do so by any other means than the application of a greater power from D towards C. If the two powers are equal, there will be no motion whatever; and the degree of motion produced at last will only be the difference betwixt the two powers. If it be wanted therefore to produce a power in the direction CA, equal and opposite to that in the direction AC, one must be applied in the direction CA double to the former. This principle is different from that first mentioned, in which motion is produced by pushing against a fixed obstacle while the moving power is not resisted on the opposite side; for here the power of gravity, or whatever we suppose to act upon E, resists according to its quantity, and the whole is in the situation of the boat when hooked to the pole fig. 1. To produce motion, therefore, a new force must be applied, as if a person was to push from the bank D against the hooked pole of the boat in that figure. The principle just now laid down does not militate against the apparent ascent of bodies by the action of gravity, or the repulsion of elastic balls from one another by what is called the power of elasticity. In both cases a greater power is applied than the simple force of gravity, and with the excess of this power the body ascends, as shall be afterwards shown.

§ 5. Of the Motion produced by two or more Powers acting upon a Body in directions oblique to each other.

As the action of two powers in direct opposition to each other is attended with the destruction of both if the powers are equal, and of one of them if they are unequal; so the action of powers directed obliquely upon one another is productive of motions in various directions, according to that of the acting powers.

The motion produced by the action of two powers is always in the diagonal of the parallelogram expressed by these powers. Thus, in fig. 7. let the body A be acted upon at once by two forces, one of which would carry it from A to B in the same time that the other would carry it from A to C. The body will then describe AD, the diagonal of a square, in the time that it would have described one of the sides by a single power applied to it. This is in consequence of its obeying both forces; as it is evident that it has moved as far as from A to B, and likewise from A to C, which is precisely the effect that the two powers would have had upon it separately. In this case the body has acquired a greater power than it would have had from a single power, but less than it would have acquired from the union of the two powers if they had acted directly in concert with each other; because the diagonal of a square is less than the sum of the sides, and the power with which any body moves is exactly proportioned to its velocity. If, instead of supposing the forces equal, we suppose one of them considerably greater than the other, then the greater force

will carry the body farther in its own direction than the other, and the whole will be represented by a parallelogram, as in fig. 8. In this case it is evident that the body has moved exactly in conformity to the direction of both powers, viz. the whole length of AB, and the whole length of AC. In this case also the loss of motion is less than in the former; because the length of the oblong parallelogram approaches much nearer to the sum of the sides than the diagonal of a square; and the greater inequality there is betwixt the sides, the less power is lost.

If, instead of acting at right angles to each other, the direction of the powers forms an acute angle, as in figs. 9, 10, 11, the power produced will be considerably greater than either of the original ones; and the more acute the angle is, the greater will be the augmentation, as is evident from an inspection of the figures. The reason of this, though not quite so obvious, is the same with the former. Thus the body A in fig. 9. had it been acted upon by only one power, viz. that denoted by AB, would have been at B, or carried as far forward as E, the half of the diagonal; its oblique direction upward not being taken into the account. Had it been acted upon by the force AC alone, it would have been at C with an obliquity as far down as the other is up. As these obliquities, however, are in contrary directions, they must of necessity destroy one another; and therefore the body moves neither to one side nor another, but proceeds with the sum of the direct forces of the powers, or those by which they move in the straight diagonal. But either of the two powers would have brought it forward as far as E; of consequence both conjoined must carry it on to D, the whole length of the diagonal. Thus it appears, that when a body is acted upon by two powers which partly conspire together, the power produced will be the exact sum of them as far as they do conspire, and the loss arises entirely from the opposition betwixt them; for all powers which do not directly conspire, oppose one another in a certain degree. Hence when the acting forces make an obtuse angle with each other, as in figs. 12, 13, there is then a very great loss of power, because there is such an opposition betwixt them; and it is only that small part of their motion which acts in concert that can produce any in the body acted upon; but this, as in the former case, is exactly double to what it would be if only one of them acted upon the body. Thus, in fig. 12. the whole direction of the powers from E to B, and from B to C, is in absolute opposition to each other; and therefore, supposing them equal, must be totally lost. In the direction AD they conspire; and therefore the body will move twice as far in that direction as is expressed by that of the lines in the figure; that is, from A to D, instead of only from A to E, which is the limit of each of the forces. In cases of this kind, the more obtuse the angle is at which the forces act, the greater is the loss of power, as is evident from an inspection of figs. 12, 13.

Some who are but beginning to the study of mechanics may be embarrassed in their ideas how two forces acting at right angles to each other can in any manner of way oppose each other, as in fig. 7.; as we find that a body descending by the force of gravity

Plates'
CCLXXXII.
CCLXXXIII.

Mechanical
Power.
Plate
CCLXXXIII.

may be pushed to a side seemingly by the least force imaginable. But this will easily be understood from fig. 14. which is only a square turned into another position. Here it is plain that the powers AB and AC oppose each other as much as they conspire; that is in the proportion of half the diagonal of the square: this quantity therefore is totally lost, and the body proceeds with the other half; which being doubled on account of each of the powers proceeding with one half of the diagonal, gives the whole diagonal for the total motion produced.

5
Ultimate
cause of
this shown

But however plain this may appear from an inspection of the figure, it is by no means so apparent when we come to try it by numbers. Thus, supposing each of the sides AB and AC to be 5, the diagonal of the square will be nearly 7.071; but if from the sum of the sides 10 we take this number, or half of it from each number, we will have only 2.919 for the whole motion, instead of the diagonal 7.071 which is the reality. From an inspection of the figure also we plainly see, that if one diagonal is gained by the powers conspiring together or acting in concert, another is lost by their opposition. It is natural therefore to inquire, How can any two powers gain or lose more than their own quantity; for the two powers taken together amount but to ten, but the two diagonals, one of which is gained and the other lost, amount between them to upwards of fourteen? To solve this seeming paradox, we must consider, that as the diagonal of the square ABCD, fig. 14. is generated from the two sides AB and CD, so these sides themselves may be accounted the diagonals of two other smaller squares ABE and AEC, fig. 15. each of the sides of which is half the diagonal of the large one. From the sum of the sides of these squares, which to the large square are the source of power, it is evident that a diagonal may be taken and another remain, because each of the sides is half a diagonal.

6
All powers
are com-
pounded of
others.

Hence we not only see that every mechanical power we are acquainted with may be derived from two others, but have a demonstration that it *actually is so*; not only because this supposition explains the phenomena, but because we are involved in an inexplicable contradiction if we suppose any thing else, for no power can lose more than its own quantity; and if it loses more than one half, it can never produce effects equivalent to another half; which we see must be the case, if we suppose any two unoriginated powers acting upon one another at right angles, or indeed any other way, though the supposition of their acting at right angles makes the matter more plain than any other. This leads to a very curious speculation concerning the origin of mechanical motion, of which an account is given under the article MOTION.

7
Experiment
illustrating
the truth of
this doc-
trine.

Hitherto we have considered both the powers not only as equal at the beginning, but as continuing so throughout their whole course: but this is a supposition which scarcely exists in nature, unless the powers are kept from exerting themselves otherwise than by simple pressure. Thus, in fig. 16. supposing the body A pulled in the direction AB by the weight D of five pounds put over the fixed pin B, and pulled in the direction AC by C, another weight of five pounds fastened to it by a string; the whole will be kept in the position represented in the figure by a weight of

7.071 pounds fastened to it by a string, and put over the pin F, situated any where in the diagonal line FAG; and let us add ever so much weight, provided it be done to D and C in the proportion of five, and to E in that of 7.071, the body A will remain suspended in the air without altering its position in the least.

If, instead of making the weights equal, we make one exceed the other in any proportion, the weight necessary to counteract them will never be required equal to both, but will always be in proportion to the diagonal of the parallelogram of which the weights represent the sides. Thus, in fig. 17. if we suppose the body A pulled in the direction AB by the weight G of four pounds, and in the direction AC by the weight H of three pounds, it will be kept suspended by the weight F of five pounds put over the pin E, placed any where in the diagonal line EAD. For the diagonal AD is equal (by Prop. 47. Book 1. of Euclid) to the square-root of the sum of the squares of the sides AB and AC, or CD and BD. But the square of AB is $4 \times 4 = 16$ pounds, and that of AC is $3 \times 3 = 9$ pounds by the supposition; and $16 + 9 = 25$, the square-root of which is 5; and these proportions will be found to hold invariably in whatever way we apply mechanical powers; though, when they act at oblique angles, the diagonals must be calculated by other methods.

If, however, we set any of the powers at liberty, we shall find that none of them will continue the same even for a moment. If we suppose any of them to be the power of gravity, which is the most constant and equable we are acquainted with, this is found to increase prodigiously; and, on the other hand, if we suppose one of them to be a projectile force, as of a stone thrown by the hand, we will find in like manner, that it will be diminished to a great degree in a very little time. In all cases, however, where a body is acted upon by two forces either increasing or decreasing, unless both increase or decrease exactly in proportion to their original quantity, the body acted upon will describe a curve. Thus, in fig. 18. suppose the body A to be acted upon by two equal powers AB and AC; at the end of the first moment it will be at *d*, the end of the diagonal of the small square *Abcd*; but if now the force AC be increased to double what it was in the preceding moment, the body will at the end of the second moment be at *g*, the extremity of the parallelogram *dgfg*; and by another increment of the same power, will be at the end of the third moment at *k*, and so on. This is similar to the motion of falling bodies, of which we shall treat hereafter; but if one of the powers diminishes instead of increasing, the phenomena will be different. Thus, in fig. 19. supposing the body at A to be actuated the first moment by the two forces AB and AC; at the end of that moment it will be at the extremity of the diagonal AD; but next moment, supposing the power AC to be diminished one half, the other remaining the same, it will then be at *g*, and the third moment at *k*, thus describing another kind of curve. If, while one of the powers decreases the other increases, a third kind of curve will be generated; and by proper management of these powers, the body may be made to describe the segment of a circle, as in fig. 20; where

Mechanical
Power.

8
Curvilinear
motion
now pro-
duced.

Mechanical Power. where it is manifest that one power continually decreases while the other increases.

Machine for showing the action of oblique powers. Fig. 21. The following machine has been contrived to illustrate the operation of oblique powers upon each other. ABCD is a wooden square, so contrived that the part BEFC may draw out from it or be pushed back at pleasure. To this is joined a pulley H, freely moving upon its axis, which will be at H when the piece is pushed in, and at *b* when it is drawn out. To this part let the ends of a straight wire *k* be fixed, so as to move along with it under the pulley; and let the ball G be made to slide easily upon the wire. A thread *m* is fixed to this ball, and goes over the pulley to I; by which means the ball may be drawn up on the wire parallel to the side AD, when the part BEFC is pushed as far as it will go into the square: but when this part is drawn out, the ball must be carried along with it parallel to the bottom of the square DC. Thus the ball may be drawn either perpendicularly upward by pulling the thread *m*, or moved horizontally by pulling out the part BEFC, in equal times and through equal spaces, each power acting equally and separately upon it. But if, when the ball is at G, the upper end of the thread be tied to the pin I, in the corner A of the fixed square, and the moveable part BEFG be drawn out, the ball will then be acted upon by both the powers together: for it will be drawn up by the thread towards the top of the square, and at the same time carried with its wire *k* towards the right hand BC, moving all the while in the diagonal line L, and will be found at *g* when the sliding part is drawn out as far as it was before; which then will have caused the thread to draw up the ball to the top of the inside of the square, just as high as it was before when drawn up singly by the thread without moving the sliding part.

To Of bodies acted upon by three forces. If a body is acted upon by three forces, the investigation becomes somewhat more complex, though it is still easily explained on the foregoing principles. Thus, in fig. 22. let the body A be pulled sidewise in opposite directions by the two equal weights GG put over the pins B and C, and directly downward by the weight H, the same with G. In this case it is plain, that each of the weights G and C sustain one half of the weight H; and as both taken together are double in quantity to H, it might be supposed that they would be abundantly able to keep the body A in its position. The case, however, is very different. As each of the weights G sustains only one half of H, it follows that H acts only with one half of its weight upon them. The body A, therefore, is pulled in the direction AC and AB by two powers, each of which is as 2, and in the direction AF by two, which are only as one. With the force AB, therefore, were it to act upon it singly, it would describe the diagonal AD, and with that AC it would describe the diagonal AE. These two diagonals are in truth the forces by which it is now actuated, and the effect is precisely according to the principles already laid down. By each of them taken separately, the body would be brought down to F; their lateral action being in opposite directions destroys itself; and by their conjunct action, the body would be brought down to double the space AF, that is to H, and consequently would describe the diagonal of the small square ADHE; which diagonal is

equal to the side of the large one, and the very same that the body would have described though the two lateral weights had not been present.

Hence it appears, that though we pull a body ever so strongly by strings in a direction opposite to each other, it will still require an equal weight to retain it in equilibrium; that is, supposing the strings to be perfectly flexible. There may indeed be a deception in making an experiment of this kind; for the body will never descend as far as H, nor near that distance; but then it must be observed, that when the strings begin to bend in the middle, the weights GG act in a direction different from what they did originally, and pull the body upwards instead of laterally; in which case, it must either remain at rest, as in fig. 23. or move upwards, as in fig. 24.

When the powers act in the direction AB and AC, fig. 23. one half of the weight H is sustained by each of them. The body is therefore pulled in the directions AB and AC by two powers, each of which is as 2; and in the direction AF by other two, each of which is as 1. By the power AB it would be made to move in the diagonal AD of the parallelogram ABDF; and by the power AC, in the diagonal AE of the parallelogram ACEF; but these diagonals are equal and contrary to each other, and therefore destroy each other; of consequence the body remains at rest.

In fig. 24. the body A with the weight H appended to it is placed nearer to the point B than to C by one-third. Of consequence, as will afterwards be explained, it bears two-thirds of the weight H, while C sustains only one-third. The acting powers, therefore, are now the diagonals of two unequal parallelograms. One power draws the body in the direction AB with a force as 3, while the weight H draws it in the direction AH with a force as 2. By it, therefore, the body would be drawn in the direction of the diagonal AD of the parallelogram BDEA. On the other hand, it is acted upon by the power AC, which is likewise as 3, while the weight H draws it down with a force only as 1. By this, therefore, it would be drawn in the direction of the line AG, the diagonal of the parallelogram ACGF. We must now make these two diagonals the sides of a third parallelogram ADIG; and in the diagonal AI of this parallelogram it will go, for the reasons already given.

If four or more forces act upon a body in different directions, the case becomes very complicated; and if acted upon many powers be employed, it will by no means be easy by four or more forces to determine *a priori* which way the body will tend. Cases of this kind, however, seldom occur in practical mechanics; and when they do, it will be better to determine them by actual experiment than by a tedious investigation, which, after all, may be liable to a mistake. We forbear, therefore, to give more examples; though, if the reader inclines to exercise his ingenuity, he must proceed upon the plan already laid down, viz. by combining the different powers together; forming diagonals from these parallelograms; combining these diagonals into a third set of parallelograms; and the diagonals thence resulting into a fourth set, &c. until at last a single one is met with prevailing over all the rest, or two destroying each other. If one prevails, the

Mechanical
Power.

body will move in that direction; but if two destroy each other, the body will remain at rest.—It must also be observed, that in making drawings of this kind, the longest line always represents the greatest power, and that without a single exception to the contrary. By mere mechanical construction, therefore, with scale and compass, we may be able to ascertain the direction of oblique powers to as great accuracy as we can ever have occasion for in practice.

12
Of the various ways in which powers may be produced.

We shall conclude this subject with observing, that as every power certainly is produced by the action of two others, so it may be by innumerable others. Thus, in fig. 25. the power AD may be produced by the two sides of the square ABCD; by the sides of the oblique-angled parallelogram AaDb, of the smaller parallelogram AdDd; or of the large parallelogram AE, DF, &c. Hence it is easy to produce any power, whether strong or weak, from the action of any two powers whose direction we have at our command, without regard to their quantity. If we make the generating powers conspire together, a strong one will be produced; or if they oppose each other to a certain degree, they will produce a weak one. The strongest that can be produced by any two powers is when they act the same way in a direct line.

§ 6. Of the Relation betwixt Velocity and Power.

HITHERTO we have supposed the bodies to be moved not to make any resistance to motion in any direction, unless opposed by a fixed obstacle; in which case, velocity and power would be the same thing; and thus it always appears to be when we represent powers by lines upon paper. But when we come to practice, matters turn out very different. A ball of cork moving with any degree of velocity will not have an equal power with one of wood moving with the same velocity; neither will a wooden ball have the same power with a metallic one. Among the metals themselves, too, there is a difference; for the lighter metals are inferior in power to the heavier ones. Gravity, therefore, must be accounted the power which gives to moving bodies what we call their force or momentum; for according to the weight of a body, so will its impulse always be, and that whether it moves upwards, downwards, sidewise, or in a circle. The absolute power of a body, therefore, must be measured by comparing the gravity of different bodies together, and denoting one of them by unity; making the other 2, 3, 4, &c. according as it is twice, thrice, or four times, the specific gravity of the former. Thus let an hollow ball of metal be filled with water; if the ball be very thin, we may let its weight pass unnoticed, or we may make allowance for it in the calculation. Supposing the weight of this ball then to be 1, if it moves with a velocity of 10 feet in a second, its absolute force or momentum will be $10 \times 1 = 10$; a ball of stone of equal size which weighs three times as much as the former, if moved with an equal velocity, will have a force of $10 \times 3 = 30$; a ball of tin which weighs 7 times as much, will have a momentum of 70; and a ball of gold or platinum would have a momentum of 190 or 200.

This will also hold exactly, by increasing the quantity of matter, where it is deficient in specific gravity. Thus, if the hollow metallic ball be increased in dia-

meter, so that it shall equal in weight the ball of stone or metal, it will have the very same force with that ball; and in like manner, it might be made to have a momentum equal to the metallic balls, though not without a very considerable increase of size.—Great Mr Atwood's observation is, that the place of wood's observation is, that the battering-rams used by the ancients were no less efficient in beating down the walls of cities than the modern artillery. "The battering-rams of the ancients (says he) consisted of very large beams of wood terminated by solid bodies of brass or iron; such a mass being suspended as a pendulum, and driven partly by its gravity and partly by the force of men against the walls of a fortification, exerted a force which, in some respects, exceeded the utmost effects of our battering cannon, though in others it was probably inferior to the modern ordnance. To compare the effects of the battering-ram, the metal extremity of which suppose equal to a 24 pounder with a cannon-ball of 24 pounds weight; in order that the two bodies may have the same effect in cutting a wall or making a breach in it, the weight of the aries must exceed that of the cannon ball in the proportion of the square of 1700, the velocity of the ball*, to the square of the velocity with which the battering ram could be made to impinge against the wall expressed in feet. If this may be estimated at 10 feet in a second, the proportion of the weights will be that of about 2,890,000 to 100, or of 28,900 to 1; the weight of the battering ram therefore must be 346 tons. In this case the battering-ram and the cannon-ball, moving with the velocities of 10 and 1700 feet respectively in a second, would have the same effect in penetrating the substance of an opposed obstacle: but it is probable that the weight of the aries never amounted to so much as is above described; and consequently the effects of the cannon-ball to cut down walls by making a breach in them, must exceed those of the ancient battering-rams: but the momentum of these, or the impetus whereby they communicated a shock to the whole building, was far greater than the utmost force of cannon-balls; for if the weight of the battering-ram were no more than 170 times greater than that of a cannon-ball, each moving with its respective velocity, the moments of both would be equal; but as it is certain that the weight of these ancient machines was far more than 170 times our heaviest cannon-balls, it follows, that their moment or impetus to shake or overturn walls, &c. was far superior to that which is exerted by the modern artillery. And since the strength of fortifications will in general be proportioned to the means which are used for their demolition, the military walls of the moderns have been constructed with less attention to their solidity and massy weight than the ancients thought a necessary defence against the aries; that sort of cohesive firmness of texture which resists the penetration of bodies being now more necessary than in ancient times: but it is manifest, that even now solidity or weight in fortifications also is of material consequence to the effectual construction of a wall or battery." This difference between the momentum and force of penetration is exemplified in knives, wedges, or

Mechanical
Power.

13

Mr Atwood's observation is, that the place of wood's observation is, that the battering-rams used by the ancients were no less efficient in beating down the walls of cities than the modern artillery.

* See the article Gunnery.

any sharp instruments, where a sudden blow will cause a much deeper penetration than a weight vastly greater than could be stirred from the earth by the force of the blow.

§ 7. Of the Multiplication and Increase of Power.

We have now seen that power, absolutely so called, acts in a kind of double capacity, viz. either when it impresses a great velocity upon a small quantity of matter, or when it impresses a small velocity upon a great quantity of matter. It must, however, be remarked, that the matter we speak of is always supposed subject to the laws of gravity; for what would be the consequence of putting a body in motion which had no gravity we cannot possibly conceive, because we never saw any such body. Philosophers indeed mention the *vis inertia* of matter as property distinct from gravity; but the arguments in favour of this property are now generally looked upon to be inconclusive, and gravity and the *vis inertia* looked upon to be the same.

The two modes in which absolute power acts, come precisely to the same thing whether the velocity be great or small; for it is evident, that when two pounds move with the velocity of 1, it is the same thing with one pound moving with the velocity of 2; the velocities as well as powers being exactly the same. But there is a third way in which power may be directed, in which it has not the relation to velocity already mentioned; and that is, by simple pressure, where no motion is admitted. Thus may the smallest power be made to augment itself to an inconceivable degree, as in fig. 26. Here, suppose the body A to press directly downwards upon the line AB fastened to the small wheel B, moveable upon an axis. If we suppose the extremity of the line at A to be supported so that it shall not fall to a side, the wheel B will press downward with the whole of the weight A upon the line EF, and consequently the line g must sustain the whole of this weight. But if the line EF be supported so that it cannot move perpendicularly downwards to g, it will then roll along the line EF from B towards F; and this tendency to roll in the direction just mentioned will be exactly equivalent to the weight A. Any body therefore laid on the top of a stick set up at an angle of 45 degrees, will require a power double to its own weight to keep it steady at the foot, abstracting from that which will be necessary to prevent it from falling to a side.

If now we suppose the wheel B to press laterally upon another C; and that other, by means of the line CD and wheel D, to press upon the two obstacles i and k, both of which it touches at an angle of 45 degrees; it is plain that not only each of these obstacles must bear the whole weight of the body A, but the reaction of the wheel D will press down the wheel C in the direction Cg with the very same force that D is pressed upwards. This is entirely similar to the case of the man in the boat represented in fig. 1. Thus the weight A produces a pressure equal to five times its own weight; and by multiplying the wheels and rods, we might increase the pressure as much as we please. The case is similar to that in hydrostatics, where a little quantity of liquid may be made to burst the strongest vessel.

SECT. II. Of the Mechanical Powers.

By these we understand such simple machines as are useful for comparing the velocity of various bodies together, and impressing them with greater or smaller degrees of it at pleasure; by which means we may either cause a small weight overcome a great one, or by means of a great one we may make a small weight move through a space proportionably great. Thus by means of some of these powers, indeed by any of them, we may cause a weight of one pound, by moving through the space of ten feet, raise another of ten pounds through one foot; or *vice versa*, by a weight of ten pounds moving through the space of one foot, we may make a single pound move through the space of ten feet; but by none of the powers will we be able, by moving a weight of ten pounds through one foot, to move a single pound through 11 feet; nor by a single pound moving through a space of nine feet will we be able to raise a weight of ten pounds through the space of one foot. None of the mechanic powers, as they are called, therefore, can make any absolute increase of the power applied; all that they can do is to alter the velocity of the power applied, and thus transfer it either to a larger or smaller body at pleasure; and upon this principle depends the whole practical part of mechanics. The mechanical powers are six in number, viz. the lever, wheel in axis or axis in peritrochio, the pulley, inclined plane, wedge, and screw, of all which we shall now treat particularly.

§ 1. Of the Lever.

THIS is the most simple of all the mechanical powers, and is usually no other than a straight bar of wood or iron supported by a prop, as in fig. 27. The weight to be raised is suspended at the short arm of the lever A; and exactly in the inverse proportion of the distance of the weight from the fulcrum or prop C, is the quantity of the weight at B necessary to keep it in equilibrio. Thus if the weight at A be distant one foot or one inch, it signifies nothing which, from the prop, it will require an equal weight placed at the same distance on the other side, as at 1, to balance it; but if the latter be placed at 2, then only half the weight suspended at A will balance it: if the small weight is placed at 3, then only one third will be necessary; if at 4, only one-fourth, &c. and if, as in the figure, it be removed to 10, then only one-tenth part will be required to make a balance. It must still be remembered, however, that if the lever is put in motion, the small weight must move through a space ten times as great as that through which the large one moves; so that in fact there is not any acquisition of power by means of the lever, though it is one of the instruments most commonly used in mechanics, and very serviceable in loosening stones in quarries, or raising great weights to a small distance from the ground; after which they may be raised to greater heights by other machines.

In making experiments with this kind of lever, it is necessary either to have the short arm much thicker than the long one, so that it may exactly balance the latter, or a weight must be appended to it just sufficient to keep it in *equilibrio*, otherwise no accuracy can

14
First kind
of lever.
Plate
CCLXXXIII.

Plate
CCLXXXII.

Mechanical Powers.

15
Of the steel-yard.

be expected. This lever is the foundation of balances of all kinds, whether of the common kind or of that called the *Roman statera* or steel-yard. The latter is no other than the lever represented in fig. 27. For if a scale is appended to the end A of the lever, and a weight, suppose of one pound, used as a counterpoise to the body which is to be put in the scale, it will show exactly the weight of that body, by putting it at a proper distance from the fulcrum upon the long arm. Thus if the weight when placed at the division 5 counterpoises that placed in the scale, it shows that the body weighs exactly five pounds: if it balances at 6, then it shows that the body weighs six pounds, &c. But for a more particular account of this instrument, see the article *STEEL-YARD*. To this kind of lever may be reduced several kinds of instruments, as scissars, snuffers, pincers, &c.

In levers of this kind, the fulcrum C must support both the weight to be raised and likewise that which raises it; so that the weight upon C must be the greater in proportion as the arm CB of the lever is shorter. Thus, if the arms are both equal, the fulcrum C must bear double the weight at A: if the one arm is double the length of the other, then it has only to bear the weight to be raised, and one half more; because any weight at 2 will balance one double to itself at 1; but if removed to 10, the fulcrum will only have $\frac{1}{10}$ to bear.

16
Second kind of lever.

In some cases, the weight to be raised is placed between the acting power and the fulcrum, as in fig. 28. This lever is more powerful than the other, and is likewise more easily supported, because only part of the weight to be raised, and none of that which raises it, lies upon the fulcrum. Thus in fig. 28. let the extremity A of the lever AB rest upon a fulcrum at o, and let the small weight 1, by means of a string put over the wheel or pin C, pull up the other extremity; this weight 1 will then counterpoise the large one 10, and very little additional force will be required to raise it up. It is also plain, that the whole weight to be raised being 10, the fulcrum sustains only 9 of it, for the other 1 is sustained by the string BC. It is plain also, that a lever of this kind only ten feet long will raise as great a weight as another of the former kind eleven feet in length; nevertheless there is not any absolute gain of power, because the small weight 1 must move through ten times as much space as the large one; and thus the quantity of motion is exactly equal in both. To this kind of lever we may reduce oars, doors turning upon hinges, cutting knives fixed at the point of the blade, &c. From it also we see the reason why two men carrying a burden upon a pole may bear unequal shares of the weight; for the nearer any one of them is to the burden, the greater share he bears; and if he goes directly under it, he must bear the whole. Hence, if two persons of unequal strength are to carry a burden in this manner, the weaker should always be placed at the greatest distance from it.

17
Third kind of lever.

If in this lever the moving power be put in the place of the weight, it acts at a great disadvantage; and a very great power will be requisite to overcome a small weight. The reason of this is plain from an inspection of fig. 28; for it is the same thing whether we suppose the body 10 to be the moving power, or the weight to be raised; in either case, nine-tenths of

it are spent upon the fulcrum at o; and the other tenth part at 10 will be able to do no more than balance the weight 1. Levers of this kind are only made use of when we wish to give a considerable degree of velocity to bodies; and hence the flies of clocks, mill-stones, &c. may be accounted levers of this kind; for in these the moving power is applied to a pinion near the centre of motion, and acts at a great disadvantage; the muscles of the arms or legs of a man, by their insertion near the joints, likewise act as levers of this kind; and hence the power exerted by a muscle is always much greater than the force it has to overcome.

In all cases in which the lever is applied, it is necessary, in order to give it the greatest advantage, that the moving power act in a direction exactly perpendicular to the lever itself. If this be not the case, it lever acts will be necessary to lengthen the lever in proportion to the obliquity. Thus in fig. 29, suppose the straight lever AB to rest on the fulcrum C, so that a weight of one pound may counteract 10; if the lever be bent in the direction AD, it will then be necessary to lengthen it somewhat in order to produce the same effect. If bent in the direction CE, it must be farther lengthened, and still farther if bent in the direction CF. The reason of this is, that when the weight acts on the bended lever ACF, ACE, and ACD, a part of its force is spent in giving, or attempting to give, a lateral motion to the fulcrum C; and the part thus lost is exactly equal to the advantage gained by the greater length of the lever. To make a lever of a determinate length act always with the same power, it will be necessary to have some contrivance by which the moving power may act always perpendicularly to it; as by having two circular pieces of wood or other solid matter fastened to the ends of it, round which the ropes may wrap themselves when it is put in motion, such as are represented by *ab* and *BG* in the figure.

Fig. 30. shows a kind of lever bent so that one part of it may form a right angle with the other. Here the prop or centre of motion is at the angular point C. P is a power acting upon the longer arm AC at F, by means of the cord DE going over the pulley G; and W is a weight of resistance acting upon the end B of the shorter arm BC. If the power be to the weight as BC is to CF, they will remain in equilibrium. Thus suppose W to be five pounds acting at the distance of one foot from the centre of motion C, and P to be one pound acting at F five feet from the centre C, the power and weight will just balance each other. A hammer drawing a nail is a lever of this kind. In this lever the pressure upon the fulcrum downwards is just equal to the weight to be raised; but there is likewise a lateral pressure equal to the weight P; so that the centre of motion must have a double support, otherwise the whole lever with the weight would be drawn towards the side in the direction BC.

If, as in fig. 31. and 32. the lever be bent so as to form two sides of a square, the weight to be raised will always be equal to that upon the fulcrum, in whatever place the fulcrum may be put; but both will vary according to the distance from the angular point. Thus, if as in fig. 31. the fulcrum be placed at the angular point A, the weight F appended to the extremity B

Mechanical Powers.

18
In what manner a power applied to a lever acts to the greatest advantage. Plate CCLXXXIV.

19
Fourth kind of lever.

20
Fifth kind of lever.

Fig. 13.

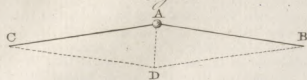


Fig. 14.

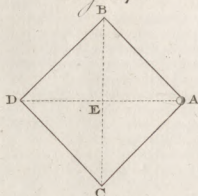


Fig. 15.

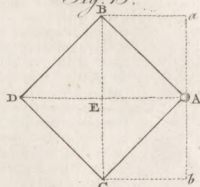


Fig. 16.

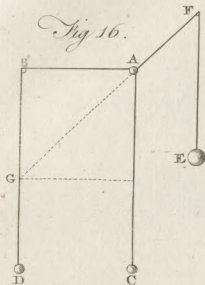


Fig. 17.

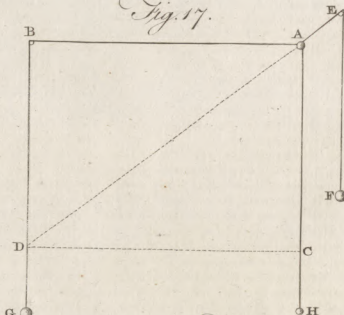


Fig. 23.

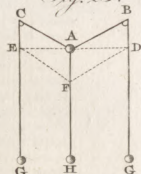


Fig. 18.

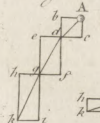


Fig. 19.

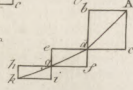


Fig. 20.

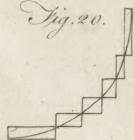


Fig. 21.

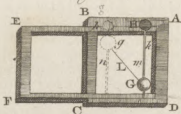


Fig. 22.

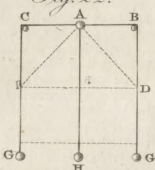


Fig. 24.

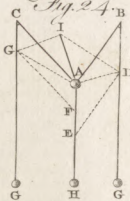


Fig. 25.

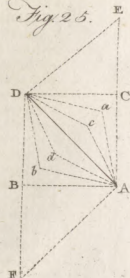


Fig. 26.

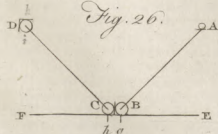


Fig. 27.

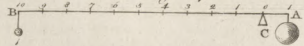
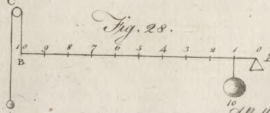
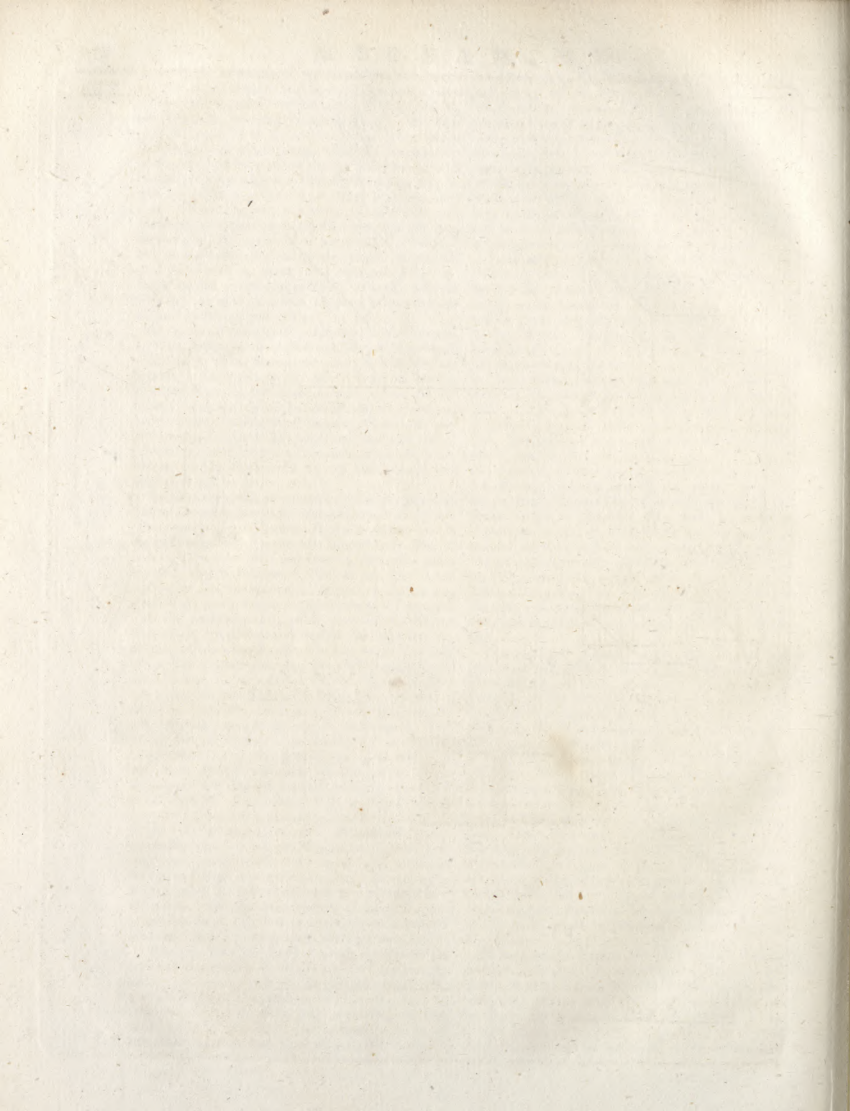


Fig. 28.





mechanical powers. of the arm AB will juſt counterpoize an equal weight E by means of the ſtring CDE put over the pin D, and drawn laterally by the arm AC. But if, as in fig. 32. the fulcrum be placed nearer to the extremity of the arm AC, as at 3, the cafe will then be very much altered, and one pound ſuſpended at the extremity B of the arm AB will counterpoize four at the extremity C of the other arm: the preſſure on the fulcrum will likewiſe be equal to the weight to be raiſed. Was the fulcrum placed at 2, then a weight of one pound at B would only counterpoize two pounds acting at C; and if it was placed at 1, then a weight of three pounds at B would be requiſite to counterpoize 4 at C.

21 If it is worth notice, that levers of this kind cannot be exactly counterpoized by the power of ſtraight levers. Thus, in fig. 33. let any weight, as C, be appended to B, the extremity of the arm of the bent lever BA4. Let DE be a ſtraight lever, the force of which we deſign to oppoſe to that of the crooked lever. For this purpoſe let another weight F act upon the extremity D of this ſtraight lever by means of a ſtring put over the pin G. Let the two levers be connected together by means of the ſtring h3, and let a piece of wood or iron E4 be put between their two extremities; the two weights being now allowed to act, it is evident that the levers will be pulled in different directions, the ſtring h3 will be tightened, and the extremity E of the ſtraight lever DE will be preſſed towards 4, while the extremity 4 of the crooked lever will be preſſed towards E; by which means the two levers will oppoſe one another in every point of their action. There is not, however, any weight whatever applied to the ſtraight lever which can be made to counterbalance that at C, in ſuch a manner as to keep the bent lever ſteady. Let us firſt ſuppoſe the weights to be each one pound, and the ſtring to be placed as in the figure at h3. In this cafe the weight C pulls the crooked lever from b towards 3, with a force equal to 4, and the extremity 4 will be preſſed towards E with an equal degree of force. But in the ſtraight lever, though the point b be pulled in the direction 3b by a force of four pounds, the extremity E is preſſed the contrary way by a force equivalent only to three. Thus the weight C muſt preponderate, and that at F will aſcend. Let us next add to the weight F one pound; by which means the preſſure from E towards 4 will be augmented to 4, and the two extremities of the levers will counteract each other: but now the preſſure in the direction 3b will be greater by one-third of a pound than it is in the direction h3; and of conſequence the weight F will prevail, the arm AB of the crooked lever and the weight appended to it being raiſed. If we attempt to mend matters by augmenting the weight F by not quite a third part, the extremities of the two levers will not balance each other, the preſſure from 4 to E will be greater than from E to 4; and in like manner the preſſure from 3 to b will be greater than from b to 3. Hence both levers will be pulled in a direction from D towards G, and the weight F will deſcend if the weights be properly adjusted without any aſcent of the other. In ſhort, let us alter the weights as we will, or let us alter the poſition of the fulcrum as we will, it is eaſy to ſee that there is an abſolute impoſſibility that the two levers can counteract each other;

because the preſſure upon the fulcrum of the crooked lever will always be equal to that by its extremity 4; but in the ſtraight lever the preſſure upon the fulcrum muſt neceſſarily be greater than that of the extremity.

These are all the varieties of the lever which can be ſuppoſed; it remains now only to ſhow the reaſon of its action, or why a ſmall weight when at reſt ſhould counterpoize a great one; motion or velocity being here to appearance out of the queſtion, as we cannot attribute any degree of motion to two bodies abſolutely at reſt. To do this in a clear and diſtinct manner has puzzled ſome of the greateſt mathematicians: that of Dr Hamilton profeſſor of philoſophy in Dublin, 22 founded upon the reſolution of forces, ſeems to be the moſt readily underſtood, and leaſt liable to objection. 'The moſt noted theorem in mechanics (ſays he) is this, "When two heavy bodies counterpoize each other by means of any machine, and are then made to move together, the quantities of motion with which one deſcends and the other aſcends perpendicularly will be equal." An equilibrium always accompanying this equality of motions, bears ſuch a reſemblance to the cafe wherein two moving bodies ſtop each other when they meet together with equal quantities of motion, that many writers have thought that the cauſe of an equilibrium in the ſeveral machines might be immediately aſſigned, by ſaying, that ſince one body always loſes as much motion as it communicates to another, two heavy bodies counteracting each other muſt continue at reſt, when they are ſo circumſtanced that one cannot deſcend without cauſing the other to aſcend at the ſame time, and with the ſame quantity of motion. For then, ſhould one of them begin to deſcend, it muſt inſtantly loſe its whole motion by communicating it to the other. This argument, however plauſible it may ſeem, I think is by no means ſatisfactory; for when we ſay that one body communicates its motion to another, we muſt neceſſarily ſuppoſe the motion to exiſt firſt in the one, and then in the other; but in the preſent cafe, where the two bodies are ſo connected that one cannot poſſibly begin to move before the other, the defending body cannot be ſaid to communicate its motion to the other, and thereby make it aſcend: But whatever we ſhould ſuppoſe cauſes one body to deſcend, muſt be alſo the immediate cauſe of the other's aſcending: ſince from the connection of the bodies, it muſt act upon them both together as if they were really but one. And therefore, without contradicting the laws of motion, I might ſuppoſe the ſuperior weight of the heavier body, which is in itſelf more than able to ſuſtain the lighter, would overcome the lighter, and cauſe it to aſcend with the ſame quantity of motion with which the heavier deſcends; eſpecially as both their motions, taken together, may be leſs than what the difference of the weights, which is here ſuppoſed to be the moving force, would be able to produce in a body falling freely.

However, as the theorem above-mentioned is a very elegant one, it ought certainly to be taken notice of in every treatiſe of mechanics, and may ſerve as a very good index of an equilibrium in all machines: but I do not think that we can from thence, or from any one general principle, explain the nature and effects of all the mechanic powers in a ſatisfactory manner:

Mechanical Powers.

22 Dr Hamilton's definition of the properties of the lever.

manner; because some of these machines differ very much from others in their structures, and the true reason of the efficacy of each of them is best derived from its particular structure.

‘The lever is considered as an inflexible line, void of weight, and moveable about a fixed point called its *fulcrum* or prop. The property of the lever, expressed in the most general term, is this: “When two weights, or any two forces, act against each other on the arms of a lever, and are in equilibrium, they will be to each other inversely as the perpendicular or shortest distances of their lines of direction from the fulcrum.”

‘This proposition contains two cases; for the directions of the forces may either meet in a point, or be parallel to each other. Most writers begin their demonstration of this proposition with the second case, which seems to be the simplest, and from which the other may be deduced by the resolution of forces. Archimedes, in his demonstration, sets out with a supposition, the truth of which may reasonably be doubted: for he supposes, that if a number of equal weights be suspended from the arm of a lever, and at points equidistant from each other, whether all these points be at the same side of the fulcrum, or some of them on the opposite side, these weights will have the same force to turn the lever as they would have were they all united and suspended from a point which lies in the middle between all the points of suspension, and may be considered as the common centre of gravity of all the separate weights. Mr Huygens, in his *Miscellaneous observations on mechanics*, says, that some mathematicians have endeavoured, by altering the form of this demonstration, to render its defects less sensible; though without success. He therefore proposed another proof, which is extremely tedious and prolix, and also depends on a postulatam, that, I think, ought not to be granted on this occasion: it is this; “When two equal bodies are placed on the arms of a lever, that which is furthest from the fulcrum will prevail and raise the other up.” Now, this is taking it for granted, in other words, that a small weight placed further from the fulcrum, will sustain or raise a greater one. The cause and reason of which fact must be derived from the demonstration that follows, and therefore this demonstration ought not to be founded on the supposed self-evidence of what is partly the thing to be proved.

‘Sir Isaac Newton’s demonstration of this proposition is indeed very concise; but it depends on this supposition, that when from the fulcrum of a lever several arms or radii issue out in different directions, all lying in the same vertical plane, a given weight will have the same power to turn the lever from which-ever arm it hangs, provided the distance of its line of direction from the fulcrum remains the same. Now it must appear difficult to admit this supposition, when we consider that the weight can exert its whole force to turn the lever only on that arm which is the shortest, and is parallel to the horizon, and on which it acts perpendicularly; and that the force which it exerts, or with which it acts perpendicularly, on any one of the oblique arms, must be inversely as the length of that arm, which is evident from the resolution of forces.

‘Mr Maclaurin, in his *View of Newton’s Philosophy*, after giving us the methods by which Archimedes and Newton prove the property of the lever, proposes one of his own, which, he says, appears to be the most natural one for this purpose. From equal bodies, sustaining each other at equal distances from the fulcrum, he shows us how to infer that a body of one pound (for instance) will sustain another of two pounds at half its distance from the fulcrum; and from thence that it will sustain one of three pounds at a third part of its distance from the fulcrum: and going on thus, he deduces, by a kind of induction, what the proportion is in general between two bodies that sustain each other on the arms of a lever. But this argument, were it otherwise satisfactory, yet as it cannot be applied when the arms of the lever are incommensurable, it cannot conclude generally, and therefore is imperfect.

‘There are some writers on mechanics, who, from the composition of forces, demonstrate that case of the general proposition relating to the lever, in which the directions of the forces are oblique to each other, and meet in a point: but I do not find that they have had any other way of proving the second case, in which the directions of the forces are parallel, but by considering these directions as making an angle with each other, though an infinitely small one, or as meeting at an infinite distance; which way of reasoning is not to be admitted in subjects of this kind, where the proof should always show us, directly from the laws of motion, why the conclusion must be true, in such manner that we might see clearly the force of every step from the first principles down to the conclusion, which we are prevented from doing when any such arbitrary and inconsistent supposition is introduced.

‘From thus considering the various proofs that have been given of this fundamental proposition in mechanics, we may see the reason why many subsequent writers have appeared dissatisfied with the former demonstrations, and have looked for new ones: I shall now propose two methods of demonstrating it, merely from the composition and resolution of forces. The proposition may be expressed as follows.

“When three forces act upon an inflexible line, whether straight or crooked, and keep it in equilibrium, any two of them will be to each other inversely as the perpendicular distances of their lines of direction from that point to which the third force is applied.”

‘Let the three forces E, G, F, (fig. 34.) act upon three points A, B, D, in an inflexible line; and first let the directions of the forces E and F (which act on the same side of the line) meet in the point C. Then it is evident that the force, which is compounded of these two, must act upon the line A B D in the direction of a right line that passeth through the point C; consequently the force G, which sustains this compounded force, must be equal thereunto, and must act in a contrary direction; therefore the force G must act in the direction of the line C B. From the point B draw B H and B K perpendicular to the directions of the forces E and F, and draw B M and B N parallel to these directions, forming the parallelogram B M C N; then, since these three forces are

Mechanical powers.

Mechanical powers.

in equilibrium, they must be to each other respectively as the sides and diagonal of this parallelogram to which their directions are parallel; therefore E is to F as CM to CN or MB, that is, (because the sides of a triangle are as the lines of the opposite angles) as the line of the angle MBC, or its alternate one BCN, to the line of the angle BCM; but making CB the radius, BK is the line of the former angle, and BH of the latter; therefore E is to F as BK to BH; so that the forces E and F are to each other inversely as the perpendicular distances of their lines of direction from the point B, on which the third force G acts. Now to compare the forces F and G together: From the point A, on which the third force acts, draw AB and AL perpendicular to the directions of the forces G and F; then, as was said before, F is to G as MB is to CB; but MB is to CB as AB to AL; because, making CA the radius, AB is the line of the angle MCB, and AL is the line of the angle MCN, or CMB its supplement, to two right ones; therefore the forces F and G are to each other inversely as the perpendicular distances of their lines of direction from the point A, on which the third force E acts; and thus the first case of the proposition is proved, in which the forces act against each other in oblique directions.

We must now consider what parts of the forces E and F act against the force G in directions parallel to GC; for it is such parts only that really oppose the force G, and keep it in equilibrium; and from thence we shall see what proportion two forces must have to each other when they are in equilibrium, and act in parallel directions. Let the three forces act upon the points A, B, and D, (fig. 35.); let them be in equilibrium, and their lines of direction meet in the point C, as in the preceding case; then, if the points A, B, and D, are not in a right line, draw the line AD meeting BC in P, and from P draw PN and PM parallel to the directions of the forces E and F; through the points A and D draw parallel lines to BC; and through B draw a perpendicular to these lines, meeting them in H and K; from the point M draw MO parallel to AD, and meeting BC in O. Now the three forces E, G, and F, that are in equilibrium, will be to each other respectively as the sides of the triangle CMP, as in the preceding case; but the force P, which is denoted by the line MC, may be resolved into two forces acting in the directions MO and OC, the former of these only urges the point A towards D, and the latter acts in direct opposition to the force G; in like manner the force F, which is denoted by the line PM, may be resolved into two forces acting in the directions OM and PO, the former of which only urges the point D towards A, and the latter acts in direct opposition to the force G; now it is evident that the force G, which is denoted by the line PC, is sustained only by those parts of the forces E and F which act against it, in directions parallel to BC, and are denoted by the lines OC and PO, which, taken together, are equal to PC; for the other parts of the forces E and F, which are denoted by MO, are lost, being equal, and contrary to each other: if, therefore, instead of the forces F and E, we suppose two other forces, R and L, to act on the points D and A, in directions parallel to BC, and to keep the force G in equilibrium, it follows, from what has

been proved, that R and L taken together will be equal to G, and that these three forces will be to each other respectively as the lines PO, OC, and PC; therefore R will be to L as PO to OC, (that is, as AM to MC, or as AP to PD, or) HB to BK; consequently the forces R and L are to each other inversely as the perpendicular distances of their lines of direction from the point B, to which the third force is applied. Now to compare the forces R and G together; since the forces R and L may be denoted by BH and BK, and are both together equal to G, that force will be denoted by the whole line KH, and therefore R will be to G as BH to KH; so that these forces are also to each other inversely as the perpendicular distances of their lines of direction from the line of direction of the third force L; and thus the second case of the proposition is proved, in which the forces act against each other in parallel directions. If the point in the inflexible line, to which one of the forces is applied, should become a fixed point, or *fulcrum*, round which the line may turn, it is evident that the other two forces will continue in equilibrium, as they were before; and therefore the property of the lever, in all cases, is manifestly proved by this proposition.

The centre of gravity of a body is said to be that point which being sustained, or prevented from descending, the body will continue at rest. From hence it follows, that when a body hangs freely from a single point and continues at rest, its centre of gravity will lie perpendicularly under the point of suspension; for in that situation only it will be sustained, and can defend no lower.

From this property, which agrees likewise to the common centre of gravity of two bodies joined together by an inflexible right line, and which may then be considered as one, I shall show that their centre of gravity is a point in the line that joins them together, so situated that the distances of the two bodies from it are to each other inversely as their weights. This theorem concerning the position of the common centre of gravity of two bodies, which is a very noted one in mechanics, I have never seen demonstrated otherwise than by inferring it from the general property of the lever: but I think the method I shall now propose of deducing it directly from the definition of the centre of gravity, is the most concise as well as the most natural, and besides it will afford us a very easy way of demonstrating the property of the lever.

Let the two bodies A and B (fig. 36.) be joined by an inflexible right line passing through their centres of gravity, and let them be suspended from the fixed point or pin at P, by the threads AP and BP, so that they may hang freely in such a position as their joint gravity will give them. When these bodies continue at rest, their common centre of gravity must lie directly under the point of suspension, or in the perpendicular line PL, consequently it must be at the point C, the intersection of the lines PL and AB; the position of which point, in the line AB, will be determined by finding out the proportion between the segments CA and CB. If the inflexible line was not interposed between these bodies, they would move till their threads coincided with the perpendicular line PL; since therefore they are kept at stand by this line, they must urge it with certain forces in opposite directions; and these

Mechanical
powers.

urging forces must be equal, since the line on which they act continues at rest: and therefore the force with which each body urges the other in the direction of this line, may be denoted by the same letter U, and we may denote the weights of the two bodies respectively by the letters A and B. Now the body A is acted upon by three forces, viz. by its weight A in the direction PC, by the force U with which the other body urges it in the direction CA, and by the reaction of the pin in the direction AP; and since these three forces are in equilibrio, and keep the body at rest, they are to each other respectively as the sides of the triangle FCA; therefore A is to U, as PC to CA. In like manner, the body B is urged by three forces, viz. its weight B in the direction PC, the urging force U in the direction CB, and the reaction of the pin in the direction BP, which forces are to each other as the sides of the triangle PCB; therefore U is to B, as CB to PC; and therefore (*ex aequo perturbate*) A is to B, as CB to CA; consequently the weights of the bodies A and B are to each other directly as their distances from the point C, which lies directly under the point of suspension, and is therefore their common centre of gravity.

When two bodies are connected by an inflexible line, and this line is supported by a prop so that their centre of gravity cannot descend, the bodies must continue to rest, and will be in equilibrio. Therefore it is easy to see how, from the theorem now demonstrated, we may prove the property of the lever in that case where the directions of the forces are parallel; and from thence the other case, in which the directions are oblique to each other, may be deduced by the resolution of forces, as is usually done. And this is the second method by which I said the general property of the lever might be strictly demonstrated.

The lever is the most simple of all the mechanic powers; and to it may be reduced the balance and the axis in *peritrochio*, or axle and wheel: Though I do not consider the balance as a distinct mechanic power, because it is evidently no other than a lever fitted for the particular purpose of comparing the weights of bodies, and does not serve for raising great weights or overcoming resistances as the other machines do.

23
Another
demonstration.

Though this demonstration will no doubt be abundantly clear to mathematical readers, yet to others less versed in that science its appearance will no doubt be somewhat obscure and perplexed. The following we subjoin as less intricate.

Let AB, fig. 37, represent a straight rod of wood or iron, fastened at the extremity A, at right angles to another piece of the same, and kept steady by two pins C and D. If a weight be put upon the extremity H of the upright rod AH, it will press down that, and along with it the horizontal rod AB, so that every point in the rod will move with the whole force of the weight. Thus, whether we suppose an obstacle to be placed at the extremity B, at the point 2, or at 1, in the horizontal rod AB, it will have exactly the force of the weight placed at H to overcome.—Supposing then that the weight would make the whole descend from A to E in one second; then it is plain that the whole power exerted by the rod in its descent would be exprest by the parallelogram ABEF. But if, instead of supposing the line AB to be the full

length represented in the figure, we suppose it to be only half that length, and cut off at 1, then the power of the weight would be represented by the parallelogram A 1 E 1. Were it still farther shortened, by being cut off at 2, then the power would be represented by the parallelogram A 2 E 2; and each of these parallelograms, however unequal they may be as represented upon paper, would in reality be equal when the experiment was made, because in no case could the weight descend with a greater force than its own. Suppose next the weight to be taken off from H, and put upon B, and the rod AB to be moveable upon the centre A; the whole power of the weight then would be exprest by the triangle ABG, equal to the parallelogram ABEF; but as every point of the lever must bear the whole impulse of the weight as before, it is plain, that as we approach towards the centre, that power is compressed into less and less space. Thus, when the weight has descended from B to G, though the large triangle ABG be equal to the parallelogram ABEF, yet the smaller triangle A 1 1 is equal only to one half of the parallelogram A 1 E 1, which represents the power. The whole power being therefore compressed into half the space, must of necessity be double to what it was in the former case. In like manner, the triangle A 2 2, is only equal to one half of the parallelogram A 2 E 2; and this parallelogram itself is only half the space representing the whole power of the weight. In this case, therefore, the power is confined within one fourth part of the space which it naturally has, and for that reason must be four times as great.

§ 2. Of the Wheel and Axle, or Axis in Peritrochio.

THIS power acts entirely upon the principles of the lever, and has therefore sometimes been called a perpetual lever. In it the power is applied to the circumference of a wheel by means of a rope or otherwise, the weight to be raised being fastened to a rope which winds round the axis. It is represented fig. 38, where AB is the wheel, EDF its axis, P the moving power, and W the weight to be raised by means of the rope K coiling itself about the axis. It is plain then from an inspection of the figure, that when the large wheel has made one revolution, the weight P will have descended through a space equal to the circumference, and as much of the cord I, by which it is suspended, will be wound off. On the other hand, the weight W will have ascended only through a space equal to the circumference of the axle, and just so much of the rope K will be wound up upon it. As the circumference of the wheel, therefore, is to that of the axis, so will the velocity of the moving power be to that of the weight to be raised, and of consequence such will be the force of the machine: thus, if the circumference of the wheel be eight, ten, twelve, or any number of times as large as that of the axle, one pound applied to the circumference will counter-balance eight, ten, twelve, or more pounds, applied to the axle, and a small addition will raise it up.

The engines called cranes, for raising great weights, are no other than wheels of this kind. Sometimes they are moved by handles S, S, &c. placed on the circumference of the wheel, which is turned by mens hands, as is shown fig. 38. Sometimes the wheel is hollow, and

Mechanical
powers.

24
Of the engines called cranes.

furnished

Mechanical powers. furnished with steps, on which a man, who is inclofed in the wheel, continually fets his feet, as if he was afcending a flair; and thus the wheel yielding to his weight turns round, and coils up the rope which raifes the weight about its axis. When the crane is to be turned by mens hands, it may advantageouſly have cogs all round the circumference, in which a ſmall trundle may be made to work and be turned by a winch.— Thus the power of the man who works it will be greatly increaſed; for his ſtrength will be augmented as many times as the number of revolutions of the winch exceeds that of the axle D, when multiplied by the exceſs of the length of the winch above the length of the ſemidiameter of the axle, added to the ſemidiameter or half the thickneſs of the rope K, by which the weight is drawn up. Thus, ſuppoſe the diameter of the rope and axle taken together to be 12 inches, and conſequently half their diameters to be 6 inches, ſo that the weight W will hang at fix inches perpendicular diſtance from below the centre of the axle; let us ſuppoſe the wheel AB, which is fixed on the axle, to have 80 cogs, and to be turned by means of a winch fix inches long, fixed on the axis of a trundle of eight flaves or rounds, working in the cogs of the wheel. Here it is plain that the winch and trundle would make ten revolutions for one of the wheel AB, and its axis D, on which the rope K winds in raiſing the weight W: and the winch being no longer than the ſum of the ſemidiameters of the great axle and rope, the trundle could have no more power on the wheel than a man could have by pulling it round by the edge, becauſe the winch would then have no greater velocity than the edge of the wheel has, which is ſuppoſed to be ten times the velocity of the riſing weight; ſo that in this caſe the acquisition of power would be as 10 to 1. But if the length of the winch be 12 inches, the power gained will be as 20 to 1; if 18 inches, which is a ſufficient length for any man to work with, the acquisition of power will be as 30 to 1; becauſe the velocity of the handle would be 30 times as great as that of the riſing weight, and the abſolute force of any machine is exactly in proportion to the velocity of the weight raiſed by it. We muſt always remember, whoever, that juſt as much time is loſt in working the machine as there is power gained by it; for none of the mechanical powers are capable of gaining both power and velocity at the ſame time.

In all cranes, it is neceſſary to have a racked wheel, repreſented by G, on one end of the axle, with a catch H to fall into its teeth; which will at any time ſupport the weight, and keep it from deſcending, if the workman ſhould happen to let ſlip his hold. For want of this precaution, terrible accidents have ſometimes happened to people incloſed in cranes, by their inadvertently miſſing a ſtep.

§ 3. Of the Pulley.

The pulley is a ſingle wheel of wood, braſs, or iron, moveable upon an axis, and incloſed in a kind of caſe called its *block*, which admits of a rope to paſs freely over the circumference of the pulley, in which alſo there is uſually a groove to keep the rope from ſliding, the axis being generally fixed in the block.

In ſome pulleys the block is fixed; in others moveable, and riſes with the weight. Both theſe kinds are repreſented, fig. 39. AA ſhows a fixed pulley, with its block b. Over the wheel a ſtring BB paſſes, to the extremities of which are fixed the two weights W and P. This pulley, however, though it changes the direction of a power, yet does not gain any advantage; for one of the weights muſt always deſcend as much as the other aſcends, of conſequence their velocities muſt always be equal; and when this is the caſe, there can be neither increaſe nor decreaſe of power. A ſingle fixed pulley, therefore, though it may compare the weight of two bodies together, cannot be accounted in any reſpect a mechanical power. But if with a fixed pulley we combine a moveable one, or one in which the block ariſes along with the wheel, we gain an increaſe of one half. Thus if a weight W hangs at the lower end of the moveable block P of the pulley D, and the cord GF goes under the wheel, it is plain that the half G of the cord bears one half of the weight W, and the half F the other. The hook H, therefore, which ſuſtains the half G of the cord, muſt therefore bear one half of the weight; and if the cord at F be drawn up, ſo that the pulley may be raiſed from D to C, the ſtring will be extended to its whole length, all but that which goes under the wheel of the pulley D; but the weight or power P by which the ſtring is thus drawn up, will have moved twice as far as the weight W which is drawn up: whence we ſee that only one pound at P will be requiſite to counterpoize two pounds at W. If the upper and fixed block contain two pulleys, and the lower one U contain alſo two, the advantage gained by this combination will be as 4 to 1. Thus, if one end of the ſtring KMOQ be fixed to a hook at I, and the ſtring paſſes over the pulleys N and R, and under thoſe L and P, the weight T of one pound will balance a weight W of four pounds, ſuſpended by a hook from the moveable block, making allowance for the weight of the block itſelf. In like manner will the pulleys give an advantage of 4 to 1 when diſpoſed as at X and Y; but in all caſes the force relation between velocity and power is preferred as in the lever and axis in peritrochio, viz. if the power balances twice its own weight, it muſt move or have a tendency to move through twice the ſpace; if it balances four times its weight, then it muſt have a tendency to move through four times the ſpace that the other does.

Pulleys are of great uſe in practical mechanics, as Advant-
by their means great weights may be raiſed to any ges and dif-
height much more expeditiouſly than by any other advantages
method, and the ſmallneſs of their weight makes of pulleys.
them very convenient for carriage. At ſea they are uſed for hoifting the ſails and yards, ſtraightning ropes, &c. Archimedes, by means of a machine compoſed of pulleys, is ſaid to have drawn a ſhip along this ſtrand, in the preſence of Hiero king of Syracuſe; but this is ſcarcely to be credited, on account of the great friction which attends this kind of machines.— The friction ariſes from three cauſes: 1. The diameter of the axis bearing a conſiderable proportion to that of the wheels. 2. Their rubbing againſt their blocks, or againſt one another. 3. The ſtiffneſs of the rope that goes over and under them. All theſe

causes must necessarily be augmented, in proportion to the weight we have to overcome : and when we consider the immense resistance which a ship must make, with the strength and stiffness of the ropes necessary to overcome it, we can scarce suppose the strength of any individual equal to the task. Pulleys have often been used by inhuman tyrants, in constructing machines for torturing the objects of their cruelty.

26
Reason of
the effects
of the pul-
ley.

The pulley has by some writers been reduced to the lever as well as the wheel and axis ; in which method they consider the fixed pulleys as a lever of the first, and the moveable pulley as one of the second kind : but it is justly observed by Professor Hamilton, that the pulley cannot be with any propriety reduced to a lever ; because, though both the moveable and immoveable pulleys should be taken away, the ropes would have to sustain the same weight that they do with the pulleys ; nay, the very same advantages would be gained by the mere use of pins, without any wheels, were not the friction very great even upon the smoothest pins that could be made use of. It is, indeed, merely to avoid this resistance on the pins that wheels are made use of at all. The best method of computing the power, and explaining the reason of the effects of pulleys, is by considering that every moveable pulley hangs by two ropes equally stretched, each of which bears one half of the weight ; and therefore, when the same rope goes round a number of fixed and moveable pulleys, since all its parts on each side of the pulleys are equally stretched, the whole weight must be equally divided amongst all the ropes by which the moveable pulleys hang ; consequently, if the power which acts on one rope be equal to the weight divided by the number of ropes, that power will sustain the weight.

27
Mr White's
patent pul-
ley.

Plate
CCLXXXVII.

A very considerable improvement in the construction of pulleys has been made by Mr James White, who has obtained a patent for his invention, and of which the following description is given by the inventor. Fig. 68 shows the machine, consisting of two pulleys Q and R, one fixed and the other moveable. Each of these has six concentric grooves, capable of having a line put round them, and thus acting like as many different pulleys, having diameters equal to those of the grooves. Supposing then each of the grooves to be a distinct pulley, and that all their diameters were equal, it is evident that if the weight 144 were to be raised by pulling at S till the pulleys touched each other, the first pulley must receive that length of line as many times as there are parts of the line hanging between it and the lower pulley. In the present case, there are 12 lines, b, d, f, &c. hanging between the two pulleys, formed by its revolution about the six upper and six lower grooves. Hence as much line must pass over the uppermost pulley as is equal to twelve times the distance of the two. But, from an inspection of the figure, it is plain, that the second pulley cannot receive the full quantity of line by as much as is equal to the distance betwixt it and the first. In like manner, the third pulley receives less than the first by as much as is the distance between the first and third ; and so on to the last, which receives only one twelfth of the whole. For this receives its share of line n from a fixed point in the up-

per frame, which gives it nothing ; while all the other Mechanical powers in the same frame receive the line partly by turning to meet it, and partly by the line coming to meet them.

Supposing now these pulleys to be equal in size, and to move freely as the line determines them, it appears evident, from the nature of the system, that the number of their revolutions, and consequently their velocities, must be in proportion to the number of suspending parts that are between the fixed point above-mentioned and each pulley respectively. Thus the outermost pulley would go twelve times round in the time that the pulley under which the part n of the line, if equal to it, would revolve only once ; and the intermediate times and velocities would be a series of arithmetical proportionals, of which, if the first number were 1, the last would always be equal to the whole number of terms. Since then the revolutions of equal and distinct pulleys are measured by their velocities, and that it is possible to find any proportion of velocity on a single body running on a centre, viz. by finding proportionate distances from that centre, it follows, that if the diameters of certain grooves in the same substance be exactly adapted to the above series (the line itself being supposed inelastic, and of no magnitude), the necessity of using several pulleys in each frame will be obviated, and with that some of the inconveniences to which the use of the pulley is liable.

In the figure referred to, the coils of rope by which the weight is supported are represented by the lines a, b, c , &c. ; a is the line of fraction, commonly called the fall, which passes over and under the proper grooves, until it is fastened to the upper frame just above n . In practice, however, the grooves are not arithmetical proportionals, nor can they be so ; for the diameter of the rope employed must in all cases be deducted from each term ; without which the smaller grooves, to which the said diameter bears a larger proportion than to the larger ones, will tend to rise and fall faster than they, and thus introduce worse defects than those which they were intended to obviate.

The principal advantage of this kind of pulley is, that it destroys lateral friction, and that kind of shaking motion which are so inconvenient in the common pulley. " And lest (says Mr White) this circumstance should give the idea of weakness, I would observe, that to have pins for the pulleys to run on, is not the only nor perhaps the best method ; but that I sometimes use centres fixed to the pulleys, and revolving on a very short bearing in the side of the frame, by which strength is increased, and friction very much diminished ; for to the last moment the motion of the pulley is perfectly circular : and this very circumstance is the cause of its not wearing out in the centre as soon as it would, assisted by the ever increasing irregularities of a gullied bearing. These pulleys, when well executed, apply to jacks and other machines of that nature with peculiar advantage, both as to the time of going and their own durability ; and it is possible to produce a system of pulleys of this kind of six or eight parts only, and adapted to the pockets, which, by means of a skin of sewing silk, or a clue of common thread, will raise upwards of an hundred weight.

Fig. 29.

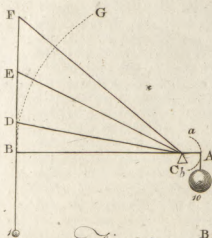


Fig. 30.

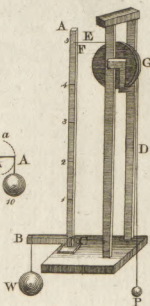


Fig. 31.

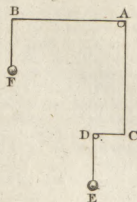


Fig. 34.

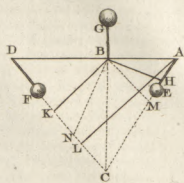


Fig. 35.

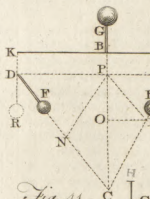


Fig. 36.

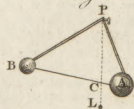


Fig. 32.

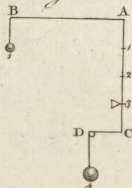


Fig. 33.

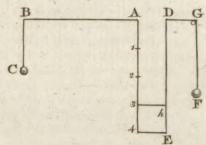


Fig. 41.



Fig. 37.

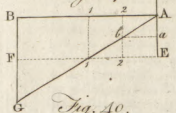


Fig. 40.

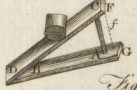


Fig. 43.



Fig. 42.

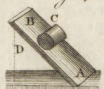


Fig. 38.

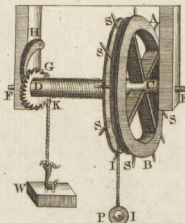


Fig. 44.

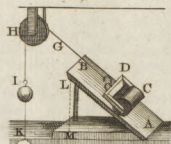


Fig. 39.

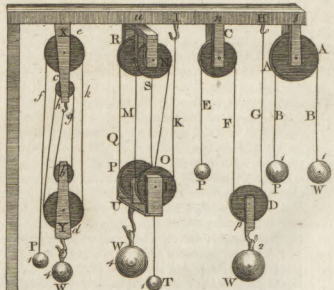
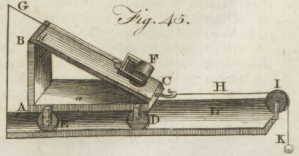


Fig. 45.



mechanical
powers.

§ 4. Of the Inclined Plane.

Plate
LXXXIV.

THIS power is represented fig. 40; and the advantage gained by it is exactly in the proportion of the length of the plane to the perpendicular height of it. Thus, let AB be a plane parallel to the horizon, and CD one inclined to it: suppose also the whole length CD to be three times as great as the perpendicular height GF; in this case, the cylinder E will be supported upon the plane CD, and kept from rolling down upon it, by one-third part of its weight. Were the length of the plane four times its height, it would be prevented from rolling down by one-fourth part of its weight. The force with which a rolling body descends upon an inclined plane will be to that with which it would descend by the power of gravity, as the height of the plane is to the length of it.—For, suppose the plane AB (fig. 41.) to be parallel to the horizon, the cylinder C will keep at rest upon any part of the plane on which it is laid. If the plane be so elevated as in fig. 42. that its perpendicular height D be equal to one half of its length AB, then the cylinder will roll down with half its weight; for it would require a power (acting in the direction AB) equal to half its weight to keep it from rolling. If the plane be elevated so as to be perpendicular to the horizon, as in fig. 43. the cylinder C will descend with its whole force of gravity, because the plane contributes nothing to the support or hinderance of it; for which reason, it must require a power equal to the whole force of its gravity to keep it from descending.

If, as in fig. 44. the cylinder C be made to turn upon slender pivots in the frame D, which is furnished with a hook, with a line G fastened to it; if this line go over the fixed pulley H, and have its other end tied to the hook in the weight I; if the weight of the body I be to the weight of the cylinder C, added to that of its frame D, as the perpendicular height of the plane LM is to its length AB; the weight will just support the cylinder, and a small force will make it either ascend or descend. In the time that the cylinder moves from A to B, it must rise through the whole height of the plane ML, and the weight will descend from H to K, through a space equal to the whole length of the plane AB. If the plane be now made to move upon rollers or wheels as in fig. 45. and the cylinder be supported upon it, the same power will draw the cylinder up the plane, provided the pivots of the wheels be small, and the wheels themselves pretty large. For let the machine ABC, equal in height and length to ABM, fig. 44. be furnished with four wheels, of which two are seen at D and E, the third being under C, while the fourth is concealed by the board *a*. Let the cylinder F be laid upon the lower end of the inclined plane CB, and the line G be extended from the frame of the cylinder about six feet, parallel to the plane CB, and fixed in that direction to a hook in the wall, which will keep the cylinder from rolling off the plane. Let one end of the line H be tied to a hook at C in the machine, and the other to a weight K, the same which drew the cylinder up the plane before. If this line be put over the fixed pulley I, the weight K will draw the machine along the horizontal plane L, and under the cylinder F; and when the machine has been drawn the whole

length CB, the cylinder will be raised to *d*, equal to Mechanical the perpendicular height AB above the horizontal powers.

The inclined plane, considered as a mechanical power, may easily be reduced to the lever; for the power acquired by it is always in the proportion of the length to the height, in the same manner as the power acquired by a lever is in the proportion of the long arm to the short one. To compute, or show the reason of the power of an inclined plane, therefore, we have only to construct a lever, the long arm of which is equal to the length of the plane, and the short arm to the height of it; then, whatever weight put upon the long arm counterpoises another put upon the short one, will also keep the same weight from rolling down the inclined plane.

To the inclined plane belong also the wedge, and all cutting instruments which act as wedges, as knives, hatchets, &c. From the theory of the inclined plane also combined with that of falling bodies, we deduce some of the most remarkable properties of the pendulum. See PENDULUM.

§ 5. Of the Wedge.

THIS may be considered as two equally inclined planes DEF and CEF, fig. 46. joined together at their bases e FO: DC is the whole thickness of the wedge at its back ABCD, where the power is applied; EF is the depth or height of the wedge; DF the length of one of its sides, equal to CF the length of the other side; and OF is its sharp edge, which is entered into the wood or other matter to be split, by the force of a hammer or mallet striking perpendicularly upon its back. Thus, AB fig. 47. is a wedge driven into the cleft CED of the wood FG.

When the wood does not cleave at any distance before the wedge, there will be an equilibrium between the power impelling the wedge downward, and the resistance of the wood acting against the two sides of the wedge: if the power be to the resistance as half the thickness of the wedge at its back is to either of its sides, and if the power be increased so as to overcome the friction of the wedge, and the resistance arising from the cohesion of the wood, the wedge will be driven in, and the wood split. But when the wood splits, as it commonly does, before the wedge, the power impelling the latter will not be to the resistance of the wood as half the thickness of the wedge is to one of its sides, but as half its thickness is to the length of the other side of the cleft, estimated from the top or acting part of the wedge; for if we suppose the wedge to be lengthened down to the bottom of the cleft at E, the same proportion will hold; namely, that the power will be to the resistance, as half the thickness of the wedge is to the length of either of its sides; or which is the same thing, as the whole thickness of the wedge is to the length of both its sides.

To prove this, let us suppose the wedge is divided lengthwise into two equal parts; in which case, it will become two equally inclined planes, one of which, as *abc* fig. 48. may be made use of for separating the moulding *cd* from the waincot AB. It is evident, that when this half wedge has been driven its whole length *ac* between the waincot and mouldings, its inside *a*: will be

Reason of
the effects
of the inclined
plane.

Plate
CCLXXXV

Mechanical
powers.

be at cd , and the moulding will be separated to fg from the waifcoat. But, from what has been already shown concerning the inclined plane, it appears, that, to have an equilibrium between the power impelling the half wedge and the resistance of the moulding, the former must be to the latter as ab to ac , that is, as the thickness of the back which receives the stroke is to the length of the side against which the moulding acts. Since, therefore, the power upon the half wedge is to the resistance against its side as the half back ab is to the whole side ac , it is plain that the power upon the whole wedge, where the whole thickness is double the half-back, must be to the resistance of both its sides as the thickness of the whole back is to the length of both sides of the cleft, when the wood splits at any distance before the wedge: For when the wedge is driven quite into the wood, and the latter splits at ever so small a distance before it, the top of the wedge then becomes the acting part, because the wood does not touch it any where else. And since the bottom of the cleft must be considered as the place where the whole resistance is accumulated, it is plain from the nature of the lever, that the farther the power is from the resistance, the greater advantage it acts with.

29
Reason of
the effects
of the
wedge.

Some have supposed, that the power of the wedge was in the proportion of the thickness of it to the length of one of its sides; but from what has already been advanced, it is plain that this cannot be the case. The wedge, as has already been shown, is composed of two inclined planes, each of which has a perpendicular height of only one half the thickness of the wedge. As the power of the inclined plane therefore is always as the length to its perpendicular height, it is evident that the power of each of these inclined planes of which the wedge is composed must be as the length of one side to half the thickness; and consequently the power of both must be as the length of both sides is to the whole thickness.

The power of the wedge is exceedingly great, inasmuch that not only wood but rocks may be split by it, which could scarce be done by any of the other powers: but in this it is assisted by percussion of the hammer which drives it, and shatters the stone in a manner that could scarcely be done by any simple pressure.—Wedges as well as pulleys have also been used as instruments of torture.

§ 6. Of the Screw.

THIS is the strongest of all the mechanical powers, though it cannot be accounted a simple one, as no screw can be made use of without a lever or winch to assist in turning it. We may suppose it made by cutting a piece of paper into the form of an inclined plane or half wedge, and then wrapping it round a cylinder, as in fig. 49. From this figure it is evident, that the winch which turns the cylinder must move once round in the time that the paper describes one spiral; and consequently if any weight or greater power of resistance were applied, the winch must turn once round in the time that the weight would move from one spiral thread to another, from d to c for instance. Hence the force of the screw will be as the circumference of the circle defined, by the lever or winch by which it is turned, is to the distance between

the threads of the screw itself. Thus, supposing the distance of the threads to be half an inch, and the length of the winch twelve inches, the circle described by the extremity of it where the power acts will be nearly 76 inches, or about 152 times the distance between the threads; whence a single pound acting at the end of such a winch would balance 152 at the extremity of the screw; and as much more as can overcome the friction would turn the winch and raise up the weight.

Fig. 50. represents a machine for exhibiting the force of the screw. Let the wheel C have upon its axis a screw ab , working in the teeth of the wheel D, which suppose to be 48 in number. It is plain that every time the screw ab and wheel C are turned round by the winch A, the wheel D will be moved one tooth by the screw; and therefore in 48 revolutions of the winch, the wheel D will be turned once round. If then the circumference of a circle described by the handle of the winch A be equal to the circumference of a groove e round the wheel D, the velocity of the handle will be 48 times as great as the velocity of any given point in the groove. Consequently if the line G goes round the groove e , and has a weight of 48 pounds hung to it below the pedestal EF, a power of one pound at the handle will balance that weight. If the line G goes round the axle I instead of the groove of the wheel D, the force of the machine will be as much increased as the circumference of the groove e is greater than that of the axle; which, supposing to be six times, then one pound at H will balance 288 pounds suspended by the line at the axle.

The screw is of very extensive use in mechanics, its great power rendering it more eligible for compressing bodies together than any of the rest, and the great disparity betwixt the velocity of the handle and that of the threads of the screw, rendering it proper for dividing space into an almost infinite number of parts. Hence, in the construction of many mathematical instruments, such as telescopes, where it is necessary to adjust the focus to the eyes of different people, the screw is always made use of in order to move the eyeglasses a very little nearer or farther away from the object glass. In the 71st volume of the Philosophical Transactions, a new method of applying the screw, so as to make it act with the greatest accuracy, is described by Mr Hunter surgeon. The following are the general principles upon which this method depends.

1. That the strength of the several parts of the engine be adjusted in such a manner to the force they are intended to exert, that they shall not break under the weight they ought to counteract, nor yet encumber the motion by a greater quantity of matter than is necessary to give them a proper degree of strength.
2. That the increase of power by means of the machine be so regulated, that while the force we can exert is thereby rendered adequate to the effect, it may not be retarded in procuring it more than is absolutely necessary.
3. That the machine be as simple as is consistent with other conditions.
4. It ought to be as portable, and as little troublesome as possible in the application.
5. The moving power must be applied in such a manner as to act to the greatest advantage; and that the

Mechanical
powers.

30
Machine
for exhibiting
the force of the
screw.

31
Mr Hunter's improvement
on the screw.

mechanical powers. the motion ultimately produced may have that direction and velocity which is most adapted to the execution of the ultimate design of the machine.

6. Of two machines, equal in other respects, that deserves the preference in which the friction least diminishes the effect proposed by the whole.

To attain all these advantages in any machine is perhaps impossible; but in the application of the screw, the following method promises to be attended with several of them.

Let AB (fig. 51.) be a plate of metal, in which the screw CD plays, having a certain number of threads in an inch, suppose 10. Within the screw CD there is a female screw*, which receives the smaller screw DE of 11 threads in an inch. This screw is kept from moving about with the former by means of the apparatus at AFG B. But if the handle CKL be turned ten times round the screw, CD will advance an inch upwards; and if we suppose the screw DE to move round along with CD, the point E will advance an inch. If we now turn the screw DE ten times backward, the point E will move downwards $\frac{10}{11}$ ths of an inch, and the result of both motions will be to lift the point E $\frac{1}{11}$ th of an inch upwards. But if, while the screw CD is turned ten times round, DE be kept from moving, the effect will be the same as if it had moved ten times round with CD, and been ten times turned back; that is, it will advance $\frac{10}{11}$ of an inch. At one turn, therefore, it will advance upwards $\frac{1}{11}$ of an inch, and the result of both motions will be to lift the point E $\frac{1}{11}$ th of an inch upwards. If now the handle be six inches long, the power to produce an equilibrium must be to the weight as 1 to $110 \times 6.2832 \times 6 = 4146.912$. Thus the force of Mr Hunter's screw is greatly superior to that of the common one; for in order to have as great a power on the plan of the latter, it must have 110 threads in an inch, which would render it too weak to resist any considerable violence.

With regard to the second general maxim above laid down, Mr Hunter considers both kinds of screws as equally applicable, only that the more complicated structure, and consequently greater expence of his screw, renders it convenient to use the common screw where only a small increase of power is necessary, and his improved one where a great power is wanted. By shortening the handle also, the whole machine is rendered more portable and less troublesome in the using.

To answer the fifth intention, both seem to be equally proper; but for the sixth, the preference must be given to such as best answer the particular purpose proposed. Thus if the screw DE be designed to carry an index which must turn round at the same time that it rises upward, the common screw is preferable; though our author also proposes a method by which his screw may answer the same purpose: With this view a still smaller screw ought to play within the screw DE, and be connected with the screw CD, so as to move round along with it. It must have, according to the foregoing proportions, 111 threads in an inch; and they must lie in a contrary direction to those of CD; so that when they are both turned together, and CD moves upwards, this other may move downwards. At one turn this will move upwards $\frac{1}{111}$ th part of an inch, and at the same time will move in a circular direction; but the accuracy

required in constructing such screws, even though made with fewer threads than those just mentioned, would probably be too great for practice. In many cases, however, screws upon Mr Hunter's principles may be of considerable use.

The theory of the screw is easily deduced from that of the inclined plane and lever; for the threads of the screw in fact form a continued inclined plane, the height of which is the distance betwixt the two threads, and the length is the circumference of the cylinder. Hence, without any lever, the screw would have a considerable power, were it not for the great friction of the parts upon one another; and this friction would be much more increased by the perpendicular action of a weight on the top of the cylinder than by the horizontal action of a lever.

§ 7. Other methods of accumulating power, which do not properly come under the denomination of any of the mechanical powers already described.

FROM the account already given of the six mechanical powers, it is evident, that they can do no more than accumulate, or, if we may use the expression, compress, any degree of velocity into a small space. The velocity thus compressed, becomes what we call power, and is capable of again impressing the original degree of velocity upon a body of an equal or nearly equal size to the first which originally impressed it; but in every case the absolute quantity of motion, or of power, remains the same without a possibility of augmentation or diminution by levers, screws, pulleys, or wedges. It follows, therefore, that if by any method we can preserve for a certain time a small quantity of motion, that will at the end of the time specified amount to an astonishing power, which we could scarce at first have imagined to proceed from so small a cause. Thus, though a man cannot raise a ton weight from the ground at once, he is easily capable of raising 100 pounds at once from the ground, and this for a considerable number of times in succession. It is plain, therefore, that in a very short time a man could in this manner raise the ton weight, if it were divided into 20 parts, as effectually as by a lever or other machine; though the fatigue consequent upon stooping down and raising up his body so often would no doubt make the toil much greater. Even by means of a lever, however, before a man could raise a ton weight one foot from the ground, with the trouble of exerting a force equal to 100 pounds, he must have a lever 20 or 21 feet in length, and exert a constant force of 100 pounds, while he goes up through a space of 20 feet, or pulls down a rope through that space. The lever, therefore, only accumulates the power exerted in pulling or carrying the weight of 100 pounds through 20 feet, and discharges it all upon the space of one foot; whence it is plain, that any other thing which could do this would raise the ton weight as effectually as the lever.

One method of accumulating a great power is by suspending a very heavy body by a chain or strong rope of considerable length. This body may be put in motion by a very small degree of power more than is requisite for bending the rope, and will acquire a vibratory motion like a pendulum; by continuing the impulse as the body returns, it will continually acquire greater and greater force, the arches through which

Mechanical powers.

Theory of the screw.

See the article screw.

Mechanical
powers.

it moves becoming continually larger, until at last it might be made to overcome almost any obstacle: and upon this principle the battering rams of old were constructed, the power of which has been already mentioned; nevertheless the power of one stroke of this engine never could exceed the accumulated power of the impulses given to it in order to produce that stroke, or even quite equal it, because the stiffness of the rope, and the resistance of the air, must always take off something from it.

Another method of accumulating force is by means of a very heavy wheel or cylinder, moveable about an axis. A small force will be sufficient to put this wheel in motion; and, if long continued, will accumulate in such a manner as to produce such effects in raising weights and overcoming resistances, as could not by any means be accomplished by the application of the original moving force. On this subject Mr Atwood has demonstrated, that a force of 20 pounds applied for 37 seconds to the circumference of a cylinder of 10 feet radius, and weighing 4713 pounds, would, at the distance of one foot from the centre, give an impulse to a mallet-ball equivalent to what it receives from a full charge of gun-powder. The same effect would be produced in six minutes and ten seconds by a man turning the cylinder with a winch one foot long, in which he constantly exerted a force of 20 pounds. In this case, however, as well as the former, there is not any absolute accumulation of power; for the cylinder has no principle of motion in itself, and cannot have more than it receives.

33
Of the use
of flies in
various ma-
chines.

This accumulation of motion, however, in heavy wheels, is of great service in the construction of machines for various purposes, rendering them greatly more powerful and easy to be worked by animals, as well as more regular and steady, when set in motion by water, or any inanimate power. Hence the use of flies, ballast-wheels, &c. which are commonly supposed to increase the power of a machine, though in reality they take something from it, and act upon a quite different principle.—In all machines in which flies are used, a considerably greater force must at first be applied than what is necessary to move the machine without it, or the fly must have been set in motion some time before it is applied to the machine. It is this superfluous power which is collected by the fly, and serves as a kind of reservoir from which the machine may be supplied when the animal slackens his efforts. This, we must observe, will always be the case with animals, for none are able to exert a great power with absolute constancy; some intervals of rest, even though almost imperceptible, are requisite, otherwise the creature's strength would in a short time be entirely exhausted. When he begins to move the machine he is vigorous, and exerts a great power; in consequence of which he overcomes not only the resistance of the machine itself, but communicates a considerable degree of power to the fly. The machine, when moving, yields for a time to a smaller impulse; during which time the fly itself acts as a moving power, and the animal recovers the strength he had lost. By degrees, however, the motion of the machine decreases, and the animal is obliged to renew his efforts. The velocity of the machine would now be considerably increased, were it not that the fly now

Mechanical
powers.

acts as a resisting power, and the greatest part of the superfluous motion is lodged in it, so that the increase of velocity in the machine is scarcely perceptible. Thus the animal has time to rest himself until the machine again requires an increased impulse, and so on alternately.—The case is the same with a machine moved by water, or by a weight; for tho' the strength of these does not exhaust itself like that of an animal, yet the yielding of the parts of the machine renders the impulse much less after it begins to move: hence its velocity is accelerated for some time, until the impulse becomes so small that the machine requires an increase of power to keep up the necessary motion. Hence the machine slackens its pace, the water meets with more resistance, and of consequence exerts its power more fully, and the machine recovers its velocity. But when a fly is added to the other parts, this acts first as a power of resistance, so that the machine cannot acquire the velocity it would otherwise do. When it next begins to yield to the pressure of the water, and the impulse of course to slacken, the fly communicates part of its motion to the other parts; so that if the machine be well made, there is very little difference in the velocity perceptible.—The truth of what is here advanced will easily be seen, from considering the inequality of motion in a clock when the pendulum is off, and how very regularly it goes when regulated by the pendulum, which here act as a fly.

Flies are particularly useful in any kind of work which is done by alternate strokes, as the lifting of large pebbles, pumping of water, &c. In this case the weight of the wheel employed is a principal object; and the method of calculating this is to compare it with the weight to be raised at each stroke of the machine. Thus, suppose it required to raise a pebble 30 pounds weight to the height of one foot 60 times in a minute: Let the diameter of the fly be seven feet, and suppose the pebble to be lifted once at every revolution of the fly; we must then consider what weight passing through 22 feet in a second will be equivalent to 30 pounds moving through one foot in a second. This will be $30 \div 22$ or $1\frac{1}{2}$ pounds. Were a fly of this kind to be applied, therefore, and the machine set a going, the fly would just be able to lift the pebble once after the moving power was withdrawn; but by increasing the weight of the fly to 10, 12, or 20 pounds, the machine when left to itself would make a considerable number of strokes, and be worked with much less labour than if no fly had been used, though no doubt at the first it would be found a considerable incumbrance to the motion. This is equally applicable to the action of pumps; but the weight which can be most advantageously given to a fly has never yet been determined by mechanics. It is certain, however, that the fly does not communicate any absolute increase of power to the machine; for if a man or other animal is not able to set any mechanical engine in motion without a fly, he will not be able to do it though a fly be applied, nor will he be able to keep it in motion though set a-going with a fly by means of a greater power. This may seem to be contradicted by the example of a common clock; for if the pendulum be once stopped, the weight is not able to set it in motion again, though it will keep it going when once put in motion by an external power. This, however, depends

34
Of the
weight of
flies.

Fig. 46.



Fig. 47.



Fig. 48.



Fig. 49.

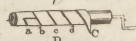


Fig. 50.

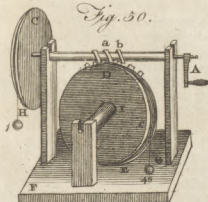


Fig. 51.

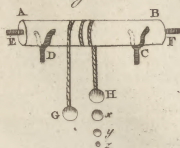


Fig. 52.

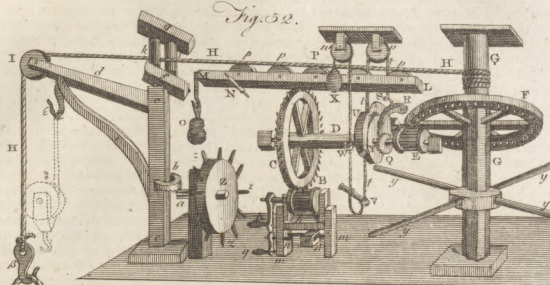


Fig. 53.

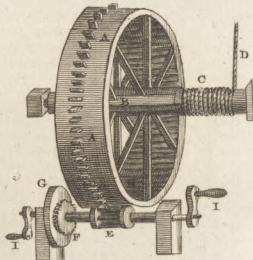


Fig. 54.

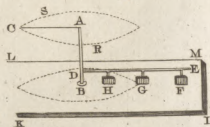


Fig. 55.

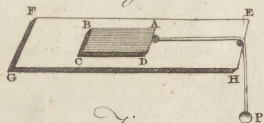
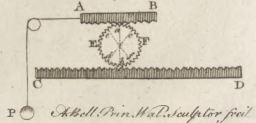


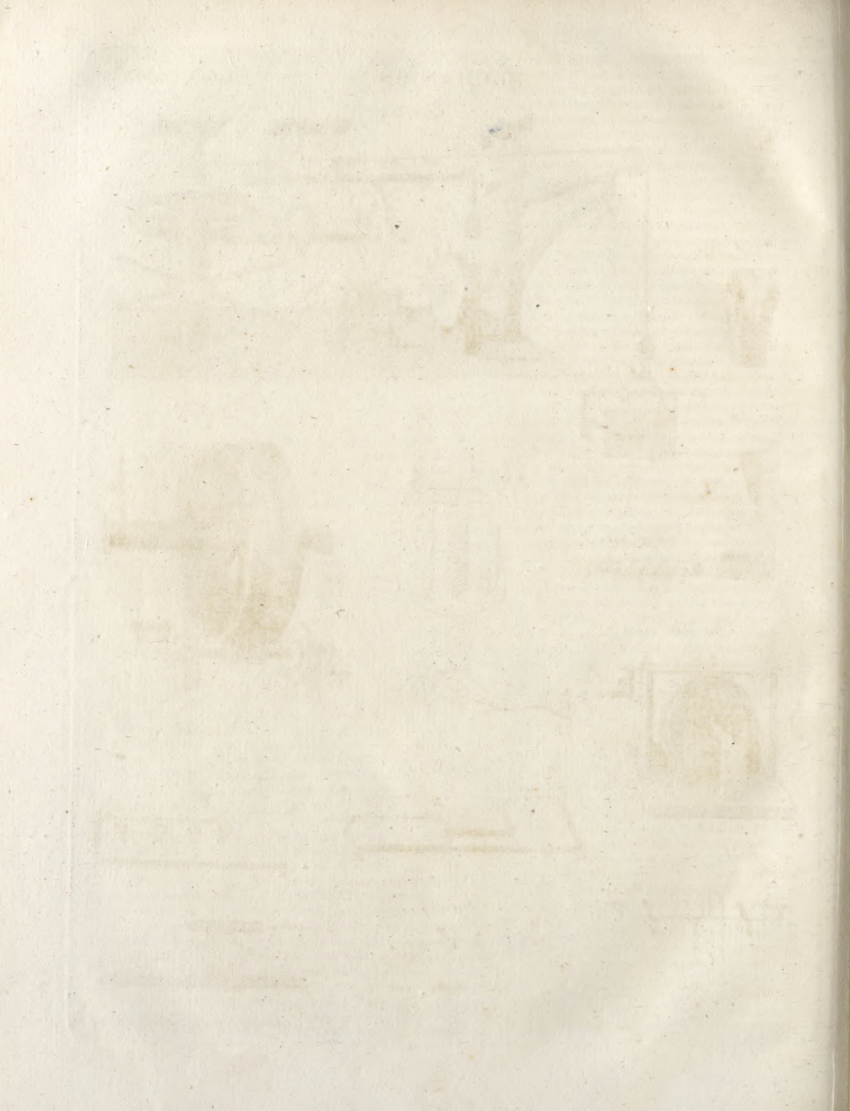
Fig. 56.



Fig. 57.



Abell, Prin. Ma.D. Sculptor fecit.



Mechanical Powers.

Mechanical Powers.

depends not upon any insufficiency of the weight, but on the particular mechanism of the crown wheel; which is such, that when once the pendulum is stopped, it would require a much greater weight than that commonly applied to set it in motion; and if the usual weight was to act fairly, it would be more than sufficient to move all the machinery, and make the pendulum vibrate also with much greater force than it does.

§ 8. Of Friction.

THE doctrine of friction, according to Mr Ferguson, may be summed up in the following manner: 1. When one body insits on another upon a horizontal plane, it presses it with its whole weight; which being equally reacted on, and consequently the whole effect of its gravity destroyed by the plane, it will be absolutely free to move in any horizontal direction by any the least power applied thereto, provided both the touching surfaces be perfectly smooth. 2. But since we find no such thing as perfect smoothness in the surfaces of bodies, but an evident roughness or unevenness of the parts in their surface, arising from their porosity and peculiar texture, it is easy to understand, that, when two such surfaces come together, the prominent parts of one will in some measure fall into the concave parts of the other; and therefore, when an horizontal motion is attempted in one, the fixed prominent parts of the other will give more or less resistance to the moving surface, by holding and detaining its parts; and this is what we call *friction*. 3. Now since any body will require a force proportional to its weight to draw it over a given obstacle, it follows, that the friction arising to the moving body will always be in proportion to its weight only, and not the quantity of the surface by which it bears upon the resisting plane or surface. Thus, if a piece of wood four inches wide and one thick be laid upon another fixed piece of the same wood, it will require the same weight to draw it along, whether it be laid on its broad or narrow side. 4. For though there be four times the number of touching particles on the broad side (*ceteris paribus*), yet each particle is pressed with but $\frac{1}{4}$ th of the weight that those are on the narrow side; and since four times the number, multiplied by $\frac{1}{4}$ th of the weight, is equal to $\frac{1}{4}$ th of the number multiplied by four times the weight, it is plain the resistance is equal in both cases, and so requires the same force to overcome it. 5. The reason why friction is proportional to the weight of the moving body is, because the power applied to move the body must raise it over the prominent parts of the surface on which it is drawn; and this motion of the body, as it is not upright, so it will not require a power equal to its whole weight; but being in the nature of the motion on an inclined plane, it will require only a part of its own weight, which will vary with the various degrees of smoothness and asperity. 6. It is found by experiment, that a body will be drawn along by nearly $\frac{1}{4}$ d of its weight; and if the surfaces be hard and well polished, by less than a third part; whereas if the parts be soft or ragged, it will require a much greater weight. Thus also the cylinder of wood AB, if very smooth, and laid on two well polished supports CD (having been first oiled or greased), and

then charged with the weight of two pounds in the two equal balls GH, it will require an additional weight x , equal to about a third part of the two pounds, to give motion to or overcome the friction of the said cylinder. 7. Now this additional weight, as it causes a greater weight of the cylinder, will likewise increase the friction; and therefore require the addition of another weight y , equal to the third part of its own weight; for the same reason, the weight y will require another z , a third part less; and so on *ad infinitum*. Hence, supposing the friction to be precisely a third of the weight, the first weight with all the additional ones, *viz.* $2, \frac{2}{3}, \frac{2}{9}, \frac{2}{27}$, &c. will be a series of numbers in geometrical progression decreasing. Now the sum of all these terms, except the first, is found, by a well-known theorem in arithmetic, to be equal to one pound. So that if the weight of the cylinder be inconsiderable, the readiest way to overcome the friction would be to double the power G, or H, at once. 8. But though we may, at a medium, allow a third part of the weight with which any simple machine is charged for the friction arising from thence, yet this is very precarious, and seldom is the case: for if ABCD be a piece of brass of six ounces, and EFGH be also a plate of brass, and both the surfaces well ground and polished, the weight P of near two ounces will be required to draw along the body AC alone; but if AC be loaded with 6, 8, or 10 lb. then a sixth part of the weight will be sufficient to draw it along the plane. On the other hand, if the plane be covered with a linen or woollen cloth, then a third or half part, and sometimes more, will be requisite to draw it along on the plane. 9. Yet notwithstanding the difficulty and uncertainty attending the estimation of the quantity of friction, it is still a most useful and necessary inquiry, how and by what means the friction of any machine may be diminished? In order to this, we must consider friction mechanically, or as a force acting against a power applied to overcome it. Thus suppose AB an upright stem Fig. 56. or shaft, turning freely in the socket B fixed in the table or plane IKLM; and AC, DE, two arms fixed in the said shaft, the latter of which, DE, has three pins going into a socket in the middle of heavy weights, F, G, or H, in such a manner, that when a power applied at C moves the lever AC, it causes the lever DE to protrude or thrust along the weights at F, G, or H, in a circular manner upon the table. 10. Now since we suppose the weight, all the while it is in motion, is freely and wholly supported by the plane, it follows, that all the resistance it can give to the power applied to C, is only what arises from its friction on the plane. What this friction is, will be found by applying the weight at G, so that BG be equal to AC; for then the power applied to C, acting in a tangent to the circle CRS, that shall just move the weight G, will be equal to its friction. But if the weight be applied at F, because BF is greater than AC, the same power at C, as before, will not move it, by reason its force is here increased, by having a greater velocity than the power; as, on the other hand, if placed at H, a less power at C shall move it, because of its having there less velocity than the power, as is evident from the properties of the lever. 11. Hence we understand, that though the

54.

Mechanical
Powers

weight of a machine remains the same; yet the friction may be diminished, by contriving that the parts on which it moves and rubs shall have less velocity than the power which moves it: thus, if the cylinder AB (fig. 54.) were to move on the two small pins or gudgeons E, F, the friction would be abated in the proportion of the diameter of the cylinder to that of the pins. 12. The friction on these gudgeons is still farther diminished by causing them to move on the circumference of a wheel: thus, let F be the gudgeon of the cylinder, revolving on the wheel CDE (fig. 57.), the velocity of the wheel's circumference will be the same with that of the gudgeon; but the velocity of the wheel's axis AB (which is now to be considered as the rubbing part) is less than that of the wheel, in proportion as its diameter is less than that of the wheel: for example, if the friction of the cylinder moving on its surface be $\frac{1}{4}$ part of the weight, and the gudgeon be to the cylinder as 1 : 10, they will reduce the friction to $\frac{1}{40}$ th part; and if, again, the axis of the wheel be to the wheel as 1 : 10, the wheel will reduce the friction to $\frac{1}{400}$ th part; and if the axis of this wheel be laid on the perimeter of another wheel, the friction will be reduced to a still lesser part of the weight; so that you may proceed in this manner to diminish the friction *ad infinitum*; and wheels applied in this manner are called *friction-wheels*. 13. Besides what has been already said, somewhat farther is necessary to diminish the friction of wheel-carriages. It was before observed, that friction arose chiefly by lifting the body over the prominent parts of the plane on which it is moved: now if we can contrive to move the body along without lifting or sustaining its weight, we shall move it without much friction; and this may be done by laying the body on any moveable circular subject, as rollers, wheels, &c.: because the asperities of its surface will lay hold on those of the roller, and move it likewise; and it is as evident, that when the body is drawn against the prominent parts of the roller, they immediately give way, and make no resistance. By this circular motion of the roller, its prominent parts below do only descend and move upon or over, and are not drawn against, the fixed prominent parts of the plane, and so receive no resistance from them. Hence the body is conveyed along without being lifted up, in the same manner as a wheel is moved by a pinion without any considerable resistance.

SECT. III. Of the Combinations of the Mechanical Powers.

FROM what has been already laid down concerning the mechanical powers in particular, we have seen that none of them is capable of augmenting the absolute force of any acting substance; and from thence we may justly conclude, that no combination of them can do so. In fact, these combinations are very often detrimental, and occasion a great loss of power by friction. This is the great obstacle in mechanics, and must always be greater in complex than in simple machines; and therefore the latter are always to be preferred, excepting where convenience requires some degree of complication. The lever being the simplest machine, and that attended with least friction, is always to be

used where it is requisite to raise weights for a small way. It may likewise be used with propriety where bodies are to undergo a long continued degree of pressure, and where they yield but little. For this purpose the lever ought to be of the second kind, represented fig. 28. where one end being fixed at A, a weight may be put upon the other extremity B, and the body to be pressed put at 1, 2, or any of the intermediate divisions, according to the degree of pressure it is designed to undergo. This has the advantage of giving a long and very equable pressure, and is a very advantageous method of pressing cheese or other things which do not require a very great exertion of force. Where this is requisite we must employ wedges or screws; but both these have the disadvantage of slackening their pressure on the least yielding of the materials to be pressed. Wedges therefore require to be almost constantly driven, and screws to be turned by a lever, in order to produce a constant pressure. In oil-mills the pressure is produced by wedges, which are constantly driven by great mallets lifted up by the force of the mill. Oil of sweet almonds is made by apothecaries in a press driven by a screw, and turned by a long lever assisted by a capstan.

Where it is necessary to have a considerable weight raised to some height, the pulley is the most useful power, but the friction is extremely great; the axis in peritrochio combined with a single pulley will answer the purpose extremely well, and with less friction than any machine composed of pulleys alone. The best method of constructing cranes is these two; and are very much used, especially by the commercial people, for raising goods out of ships, drawing them up into warehouses, and for lowering them down. In these operations we must observe, that lowering goods is much more dangerous than raising them, on account of the vast increase of velocity which bodies acquire every moment by the power of gravity. In the construction of cranes, therefore, it is absolutely necessary to attend to this circumstance, and to guard against accidents. The following are recommended by Mr. Ferguson: Fig. 32. shows one crane well calculated for the purposes just mentioned. When the rope H is hooked to the weight K, a man turns the winch A, on the axis whereof is the trundle B, which turns the wheel C, on whose axis D is the trundle E, which turns the wheel F with its upright axis G, on which the great rope HH winds as the wheel turns; and going over a pulley I, at the end of the arm d of the gib cde, it draws up the heavy burden K; which being raised to a proper height, as from a ship to the quay, is then brought over the quay by pulling the wheel Z round by the handles x, z, which turns the gib by means of the half wheel b fixed on the gib-post ce, and the strong pinion a fixed on the axis of the wheel Z. This wheel gives the man that turns it an absolute command over the gib, so as to prevent it from taking any unlucky swing, which so often happens when it is only guided by a rope tied to its arm d; and people are frequently hurt, sometimes killed, by such accidents.

The great rope goes between two upright rollers i and k, which turn upon gudgeons in the fixed beams f and g; and as the gib is turned towards either side, the rope bends upon the roller next that side. Were

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Combina-
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it not for these rollers, the gib would be quite unmanageable; for the moment it were turned ever so little towards any side, the weight K would begin to descend, because the rope would be shortened between the pulley I and axis G; and so the gib would be pulled violently to that side, and either be broken to pieces or break every thing that came in its way. These rollers must be placed so that the sides of them round which the rope bends may keep the middle of the bended part directly even with the centre of the hole in which the upper gudgeon of the gib turns in the beam *f*. The truer these rollers are placed, the easier the gib is managed, and the less apt to swing either way by the force of the weight K.

A ratchet-wheel Q is fixed upon the axis D, near the trundle E; and into this wheel falls the catch or click R. This hinders the machine from running back by the weight of the burden K, if the man who raises it should happen to be careless, and to leave off working at the winch A sooner than he ought to do.

When the burden K is raised to its proper height from the ship, and brought over the quay by turning the gib about, it is let down gently upon the quay, or into a cart standing thereon, in the following manner: A man takes hold of the rope *h* (which goes over the pulley *v*, and is tied to a hook at S in the catch R), and so disengages the catch from the ratchet-wheel Q; and then, the man at the winch A turns it backward, and lets down the weight K. But if the weight pulls too hard against this man, another lays hold of the handle V, and by pulling it downward draws the gripe U close to the wheel Y, which by rubbing hard against the gripe hinders the too quick descent of the weight; and not only so, but even stops it at any time if required. By this means, heavy goods may be either raised or let down at pleasure, without any danger of hurting the men who work the engine.

When part of the goods are craned up, and the rope is to be let down for more, the catch R is first disengaged from the ratchet-wheel Q, by pulling the cord *t*; then the handle *g* is turned half round backward, which, by the crank *nn* in the piece *o*, pulls down the frame *b* between the guides *m* and *m* (in which it slides in a groove), and so disengages the trundle B from the wheel C; and then the heavy hook *β* at the end of the rope H descends by its own weight, and turns back the great wheel F with its trundle E and the wheel C; and this last wheel acts like a fly against the wheel F and hook *β*, and so hinders it from going down too quick; whilst the weight X keeps up the gripe U from rubbing against the wheel Y, by means of a cord going from the weight over the pulley *w* to the hook W in the gripe; so that the gripe never touches the wheel unless it be pulled down by the handle V.

When the crane is to be set at work again for drawing up another burden, the handle *g* is turned half round forwards; which, by the crank *nn*, raises up the frame *b*, and causes the trundle B to lay hold of the wheel C; and then, by turning the winch A, the burden of goods K is drawn up as before.

The crank *nn* turns pretty stiff in the mortise near *o*, goes against the farther end of it when it has got just a little beyond the perpendicular; so that it can never come back of itself: and therefore the

trundle B can never come away from the wheel C until the handle *g* be turned half round.

The great rope runs upon rollers *pp* in the lever LM, which keep it from bending between the axle at G and the pulley I. This lever turns upon the axis N by means of the weight O, which is just sufficient to keep its end L up to the rope; so that, as the great axle turns, and the rope coils round it, the lever rises with the rope, and prevents the coils from going over one another.

The power of this crane may be estimated thus: Suppose the trundle B to have 13 flaves or rounds, and the wheel C to have 78 spur-cogs; the trundle E to have 14 flaves, and the wheel F 56 cogs: then, by multiplying the flaves of the trundles, 13 and 14, into one another, their product will be 182; and by multiplying the cogs of the wheels, 78 and 56, into one another, their product will be 4368; and dividing 4368 by 182, the quotient will be 24: which shows that the winch A makes 24 turns for one turn of the wheel F and its axle G, on which the great rope or chain HHH winds. So that if the length or radius of the winch A were only equal to half the diameter of the great axle G, added to half the thickness of the rope H, the power of the crane would be as 24 to 1: but the radius of the winch being double the above length, it doubles the said power, and so makes it as 48 to 1: in which case, a man may raise 48 times as much weight by this engine as he could do by his natural strength without it, making proper allowance for the friction of the working parts. Two men may work at once, by having another winch on the opposite end of the axis of the trundle under B, and so make the power still double.

If this power be thought greater than what may be generally wanted, the wheels may be made with fewer cogs in proportion to the flaves in the trundles; and so the power may be of whatever degree is judged to be requisite. But if the weight be so great as will require yet more power to raise it (suppose a double quantity), then the rope H may be put under a moveable pulley, as *z*, and the end of it tied to a hook in the gib at *i*; which will give a double power to the machine, and so raise a double weight hooked to the block of the moveable pulley.

When only small burdens are so raised, this may be quickly done by men pushing the axle G round by the handspokes *y, y, y*; having first disengaged the trundle B from the wheel C: and then, this wheel will only act as a fly upon the wheel F; and the catch R will prevent its running back, if the men should inadvertently leave off pulling before the burden be unhooked from *β*.

Lastly, when very heavy burdens are to be raised, which might endanger the breaking of the cogs in the wheel F; their force against these cogs may be much abated by men pushing round the handspokes *y, y, y, y*, whilst the man at A turns the winch.

We have only shewn the working parts of this crane, without the whole of the beams which support them; knowing that these are easily supposed, and that if they had been drawn, they would have had a great deal of the working parts from sight, and also confused the figure.

Another very good crane is made in the following manner:

manner : AA (fig. 53) is a great wheel turned by men walking within it at H. On the part C, of its axle BC, the great rope D is wound as the wheel turns; and this rope draws up goods in the same way as the rope HH does in the above-mentioned crane, the gib-work here being supposed to be of the same sort. But these cranes are very dangerous to the men in the wheel; for if any of the men should chance to fall, the burden will make the wheel run back and throw them all about within it; which often breaks their limbs, and sometimes kills them. The late ingenious Mr Padmore of Bristol (whose contrivance the fore-mentioned crane is), observing this dangerous construction, contrived a method for remedying it, by putting cogs all around the outside of the wheel, and applying a trundle I to turn it; which increases the power as much as the number of cogs in the wheel is greater than the number of flaves in the trundle: and by putting a ratchet-wheel F on the axis of the trundle (as in the above-mentioned crane), with a catch to fall into it, the great wheel is stopped from running back by the force of the weight, even if all the men in it should leave off walking. And by one man working at the winch I, or two men at the opposite winches when needful, the men in the wheel are much assisted, and much greater weights are raised, than could be by men only within the wheel. Mr Padmore put also a gripe-wheel G upon the axis of the trundle, which being pinched in the same manner as described in the former crane, heavy burdens may be let down without the least danger. And before this contrivance, the lowering of goods was always attended with the utmost danger to the men in the wheel; as every one must be sensible of who has seen such engines at work. And it is surprising that the masters of wharfs and cranes should be so regardless of the limbs, or even lives of their workmen, that, excepting the late Sir James Creed of Greenwich, and some gentlemen at Bristol, there is scarce an instance of any who has used this safe contrivance.

We shall describe here four new cranes invented and made by Mr Gottlieb of Hounsditch, London, who communicates them to the public as quite new in their principles, and more simple and useful than any hitherto contrived. Fig. 59. is a representation of a crane adapted for a large warehouse, where heavy goods are wanted to be drawn up from a cart or quay. One of this construction has lately been erected in Mr Camden's sugar-house, Old Gravel-Lane, London. Its operation is as follows: The horse yoked below at A turns the upright axis and the wheel B, which is about 6 feet in diameter; this turns a 3 feet wheel C, having an upright axis D through the floor turning with it, and carrying a 3 feet wheel E with perpendicular cogs. The wheel E turns two pinions F and G, the former of 8 inches in diameter, and the latter of 5 inches diameter, both fixed upon one axis. The pinion G turns a 3 feet wheel H, to which is fixed the barrel I and wheel W. The rope K winds round the barrel, and comes over the sheif-wheel L in the upper story, and the pulley M in the gib-head drawing up the goods suspended at the hook N.

By a mark made upon the rope at I, the man superintending the crane knows when the goods are raised enough for landing into the room: he then imme-

diately pushes aside the upright piece O, disengages the lever P from it; and by putting it downwards, the action of the quarter pinion at Q raises up the pinion at G; and thereby unconnects it with the wheel H. To prevent the machinery now from running backwards, a ratchet-wheel R is fixed upon the wheel H, into which a click-catch S falls. This effectually prevents the wheels going backwards by the weight at N while the man above is employed in landing the goods. When the goods are brought into the store-room, the hook N is thrown out, and the man below, from the usual call, runs to the handle U, slides the pinion T into the wheel H, then turns back the ratchet-wheel R, and pushes back the click S, then slides back again the pinion T; and the wheel H and barrel I being thus at liberty, the hook N and rope run down by their own gravity, and fresh goods are attached; then again, from the usual call, the man pushes up the lever P, fixes it at O, places the click S into the teeth of the ratchet-wheel; and the whole machinery is again in action from the horse below, that keeps constantly going without being stopped at every short interval of the landing, storing, &c.

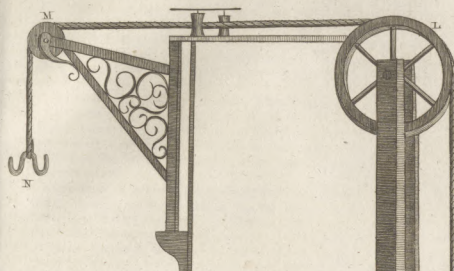
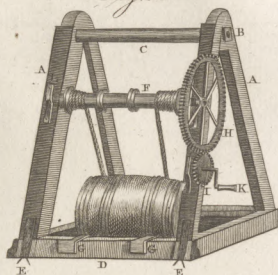
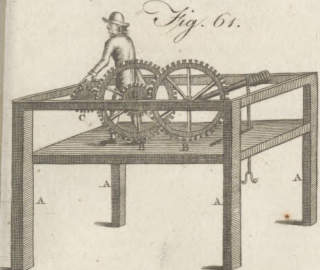
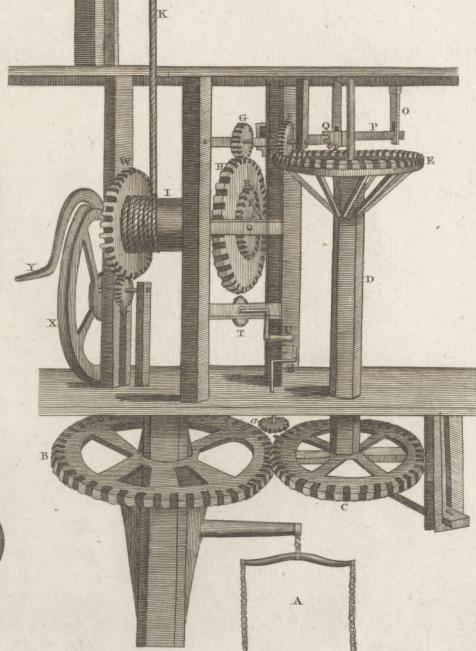
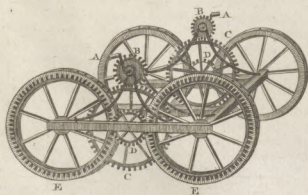
When the goods are to be carted off, and required to be let down only, it is performed without the horse, and in the following manner: The pinion G is disengaged from the wheel H by the lever P as before, and the pinion V of the fly-wheel is slipped into the teeth of the 2 feet wheel W. The goods being suspended at N, will act by the rope upon the wheel W and pinion V, thereby turning round the fly-wheel X: while the goods are thus descending, the man presses upon the lever Y, and bears against the wheel, making such a resistance as to be sufficient to allow the goods to descend with as gentle a degree of motion as may be necessary.

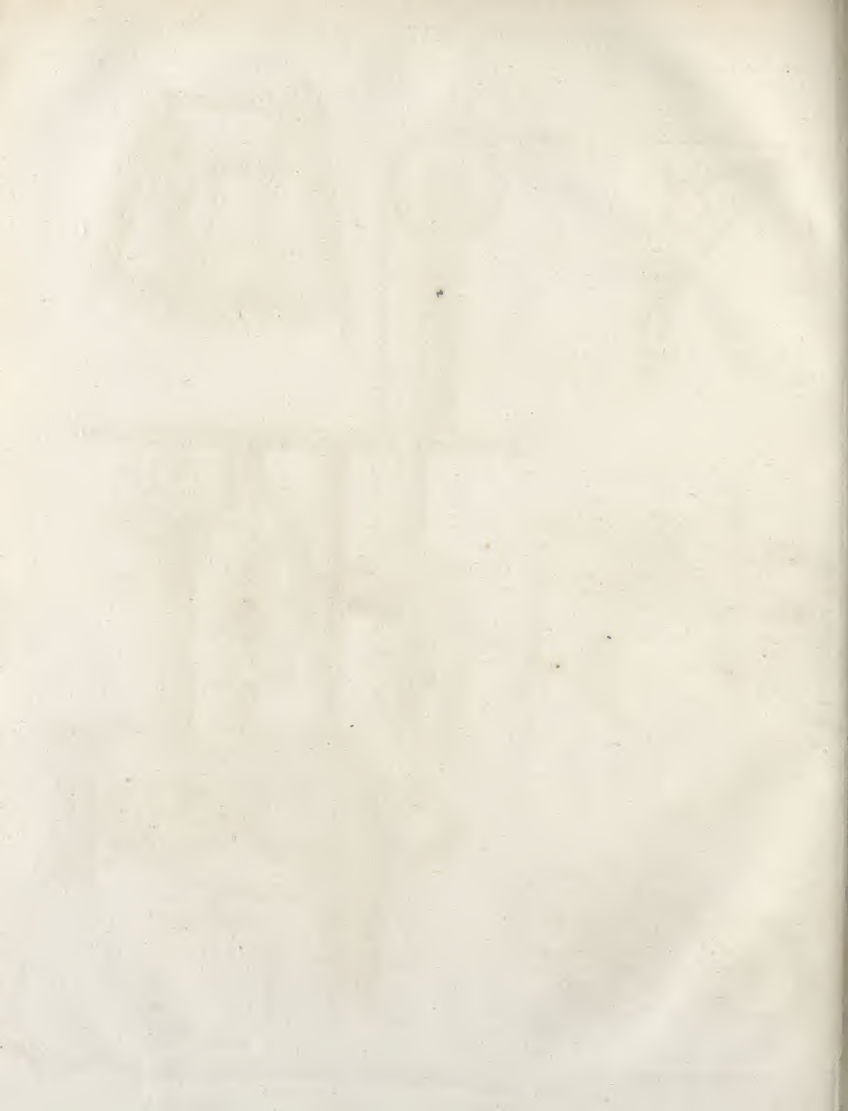
The hook N being taken from the goods, the man goes to the wheel W, and with his hands turns it round, which winds up the cord and hook in readiness for more goods, and so on as before. The pinions T and V in this case are slipped out of the wheels H and W.

As the horse at A may likewise be used to turn other mill-work from a connection made with the main-wheel, and supposing that the crane is not wanted at the same time, it is readily disengaged by turning of the winch at Z; which, by the pinion A below, working into the teeth of the bar, and the wheel C which turns upon it, quite unconnects the wheel C from the crane.

It is therefore evident from what has been described, that this crane can be managed by two men only, and occasionally without a horse, when very heavy goods are not raised. All the necessary beams for fixing the machinery by, could not be represented in the figure without obscurity and confusion; but these being omitted, will not to the most ordinary mechanic render the general construction of the crane difficult to understand.

A new portable cellar crane is represented in fig. 60. New cellar crane. This is very useful to wine-merchants, brewers, &c. in drawing up and letting down casks full of wine, beer, &c. It saves the trouble and inconvenience of horses, and in many places can be used where horses could not. AA are two wooden props about 6 feet in height, and

Fig. 59.*Fig. 60.**Fig. 61.**Fig. 62.*



Combina-
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chanical
Powers.

and joined together like a ruler at E. They are connected to each other by an iron round bar C and wooden bar at the bottom D. The iron prongs EE fasten the uprights steadily to the edge of the cellar; F is the axis round which two ropes are coiled, the ends of which are fastened to the two clamps GG. On the axis F is fixed the iron wheel H of 3 feet in diameter: in the teeth of this works the pinion I of about 6 or 7 inches in diameter, and is turned by the handle at K.

It is evident, by a bare inspection of the figure, that when the two ropes are slipped over the ends upon the barrel, either at the top or bottom of the cellar, that by turning of the winch K to wards or from you, the barrel can be safely and expeditiously taken out or lowered down.

When the crane is done with, it shuts up by unfreing the nut at B, taking the wheel and axis away out of the loops at L, and folding the sides at A together like a jointed rule; it may then be taken away in the cart or dray, or taken in the mens hands.

Fig. 61. represents a portable stone-crane mounted in a wooden frame and stage, which is judged to be very useful for loading and unloading carts with large heavy stones. It is moveable to any part of a stone-yard or ground; the frame is sufficiently wide for a cart to draw under the crane, and at any time it may be taken to pieces.

The frame AAAA is made of wood, is about 9 or 10 feet high, and about 9 feet square. The wheels BB are of iron, and are about 3 feet in diameter, and the pinion D, that is fixed to the axis of the first wheel B, 8 inches in diameter, on the axis of the second wheel B, the axis round which the rope-coils is fixed.

Now the stones being corded and hooked at the end of the rope, it is very evident that the man at C will either raise or lower them as may be necessary, according as he turns the winch towards or from him, and in a safe and very easy manner.

Fig. 62. is a representation of a crane-carriage which Mr Gottlieb conceives to be very useful in moving large stones in quarries, where carts and horses cannot be conveniently or at all managed. Its principle is evidently clear from a bare view of the figure. It consists only of two sets of crane-wheels applied to the two sets of wheels belonging to the carriage; so that two men, one at each wheel AA, turning the pinions and wheels round, shall act upon the carriage-wheels and move it along. By their both turning forwards or backwards, the carriage goes accordingly; but if they turn contrary ways, the carriage will be turned round, or partly so, as may be wanted.

The pinion B is 6 inches in diameter, which turns the wheel C of 3 feet diameter, on the axis of which is fixed the pinion D of 1 foot diameter, which works into 2 wheels E, E, of 3 feet 6 inches diameter, that are fixed upon the carriage-wheels, and give motion to the whole machine.

The friction of the axle-trees of these machines may be considerably diminished, by applying an improved axle-tree invented by Mr Gottlieb, which he calls the *anti-attrition axle-tree*, and for which he has a patent. It is formed from a steel-roller, from 4 to 6 inches

long, turning within a groove cut in the iron part of the axle; and the advantages discovered by experiments made by Mr Gottlieb will be seen by the small table subjoined. A section of this axle-tree is represented in fig. 65, where *a* is the axle-tree, *b* the groove, *c* the roller, *d* the cavity between the lower part of the tree and the box *e*. In figs. 66, 67, *f* represents the oil-veffel supplying it with oil, *g* the tube to convey the oil by, *h* the straps of ditto, *i* the fastening screws. Figs. 63, 64, give a side view of the axle.

Advantage of the anti-attrition axle-tree.

	Old axle-tree.		Anti-attrition.	
	lb.	oz.	lb.	oz.
Coaches	-	63	0	only 19
Chariots, post-chaifes, &c.	49	1	17	6
Single horse chaifes and chairs	-	31	7	6 8
Waggons	-	78	0	33 0
Drays for beer	-	138	0	43 0

One general maxim to be kept in mind by all mechanics is, that whatever a machine gains in power it loses in time, even supposing friction were entirely out of the question. It must likewise be remembered, that in almost all cases where a machine gains by complication, it will lose one third by mere friction, unless its parts are made with an accuracy not to be expected. In some cases, however, a great power must be had; and in these we must have recourse to the most simple machines, which will lose only time, and but little power by friction; for the complicated ones waste both time and power to a great degree. There is not perhaps a better method of procuring a very great power than by combining a screw with a toothed wheel which acts as an axis in peritrochio, as is represented fig. 50; for by making the threads of the screw pretty close, and the diameter of the wheel large, we may increase the power almost to any degree we please, without any considerable increase of friction. In this case, where it can conveniently be done, it is better to increase the diameter of the wheel than to add another, for this augments the power without any sensible augmentation of the friction; and it is absolutely necessary to have the axle as small as can be made of sufficient strength to bear the weight. Archimedes is said to have boasted, that he could move the earth provided he could find a place to stand on; and Bishop Wilkins, that he could pull the strongest oaks up by the roots by means of a single horse-hair. But abstracting from the impossibility in the case of Archimedes, it does not appear that the bishop could more easily have fulfilled his talk, on account of the immense friction of the machine he must have employed, and the stiffness of the great ropes which must have been bent in order to accomplish his purpose. To perform feats of this kind, a lever seems more likely than any thing; but the vast room it takes up, and the excessive length requisite to make it act with sufficient force, together with the vast weight it must necessarily have if made of the requisite strength, must easily convince us that all such extravagant boasts are vain, and that wherever great effects are to be accomplished, a great power must originally be applied.

Combina-
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Powers.

Plate
CCLXXXVII

Plate
CCLXXXVI

Wheel-carriages.

SECT. IV. Of Wheel-carriages.

Wheel-carriages.

41
Sledges
used before
wheel-carriages.

Wheel-carriages in general signify all kinds of machines furnished with wheels, for drawing great weights by means of the strength of animals or otherwise.

It is very probable, that in the infancy of the arts, sledges were used before wheels were invented, or at least before the application of them became very general. Homer mentions them as employed in bringing wood for the funeral of Patroclus; though it is not to be doubted that the Greeks at that time were acquainted with the use of wheels, as the same poet mentions them on all occasions when speaking of the war chariots of his heroes. It is possible, therefore, that by the country people, for inferior purposes, the sledge might be employed, while wheel-carriages were confined to those of superior rank, or used only for war-chariots. It is not long ago indeed since sledges were used for certain purposes in our own country, notwithstanding the number of wheel-carriages used in it from time immemorial. In some of the cold countries, where ice is met with in great quantity, and the ground is covered with frozen snow for a great part of the year, sledges are still used, and run upon the smooth surfaces of these bodies with as great ease as wheels run upon the ordinary ground. Upon very smooth ice, indeed, or upon any body perfectly smooth, wheels would not turn at all; for the only reason why they turn in the ordinary way, is the continual inequality they meet with. If we suppose the wheels to be carried in the air, it is plain that they would not turn, there being nothing to put any part in motion more than another; and the same would be the case if we could suppose ice, or any other body, to be so smooth that it would give as little resistance as air. On common roads, however, the wheels meet with obstructions at the bottom, which retard that part; and in consequence of this the upper part moves forward, and a circulating motion immediately begins to take place. By means of this circulatory motion the friction becomes very much less than what it would be if the weight were drawn along the ground upon a sledge, inasmuch that, according to the computation of Dr Hellsham, a four-wheeled carriage may be drawn with five times as much ease as one that slides upon the same surface as a sledge.

42
Obstacles
which occur
to the motion of
carriages.

The structure of wheel-carriages is so generally known, that it is needless to describe them. In the construction of them, however, there are several particulars to be observed, which may render one method of construction preferable to another, though there may be a general similarity between one carriage and another. In order to ascertain the most proper method for constructing them, it will first be necessary to consider the obstacles which occur to their motion. These are,

1. The *vis inertia* of matter.—This, though for a considerable time supposed to be a principle of mere *inactivity*, or *resistance* to any change of state from motion to rest in material bodies, is now almost exploded. Mr Antice, in a late treatise on wheel-carriages, supposes the philosophers who maintain the existence of such a principle, to have mistaken Sir Isaac Newton and other great men. According to him, they meant no more by the *vis inertia* of matter than a mere passiveness in it, by which it was disposed to abide

in that state, either of rest or motion, in which it originally was; “whereby it alters not its state but in proportion to the quantity of power exerted against it. Thus, should a body of any given weight or quantity of matter, moving with a certain degree of velocity, strike another body at rest of the same weight, it would communicate half its motion to that body, and they would move together with the same velocity as the first; but this proceeds from no principle of the body at rest to resist motion, it does not destroy in the other more than it receives from it; therefore no motion is lost, it is only divided; and the two after division have a power equal to that of the one before it, with the whole velocity of motion. Indeed when we consider that the least degree of motion in any body, however small, will communicate some degree of it to the largest in the universe; and that, on the contrary, none but an equal degree of impetus can deprive a body of actual motion, and that immediately opposed to it: add to this, that since all matter within the reach of our observation, and by analogy we have reason to think it is in actual and rapid motion, impressed on it by its great Creator, and co-existent with it; we may conclude, that if matter do not affect, it is more liable to motion than to rest.”

2. *Friction*. By this is meant the quantity of motion destroyed by bodies sliding over one another, and which is in proportion to the weights laid upon them. See Sect. II. § 8.

Friction depends not only upon the pressure made on the moving bodies, but on the inequalities on the surfaces upon which they move. For as the surfaces of even the most highly polished bodies have some inequalities, whenever two of them are pressed together, the inequalities of the one must enter, and in some degree accommodate themselves, to those of the other; and as the forms of these inequalities are of infinite variety, it is impossible to give any general description which can exactly answer to every one of them.

Mr Antice supposes the varieties only to be of two kinds, which he thinks may not be very dissimilar to any that occur. 1. Let us imagine two sliding surfaces, when viewed through a microscope, to present such an appearance as is represented in fig. 69. in which A is the sliding body to be moved in the direction CD over the fixed body B. To erect this, it is evident, that either the teeth must be violently broken off, or a power applied to them sufficient to make them slide upon each other on the principles of the inclined plane; in which case the friction must always be in proportion to the weight of the slider, and that with which it is loaded, without regard to the length or breadth of the bearing surface: for if only one pound rested upon one tooth, there would be no more but that pound to be lifted. If the pound rested upon two teeth, there would only be half a pound to be lifted over each, and so on to any number; but if we suppose the teeth to be of such a shape, that they cannot act as inclined planes, let them be ever so strong, we must calculate the friction in a different manner.

Let surfaces of this kind be represented by fig. 70. In which case it is evident, that instead of depending on the weight or pressure only, it will be in proportion to the number and strength of the teeth so lock-

Plate
CCLXXXV

ed together; or, in other words, on the length and breadth of the rubbing surfaces. On this supposition the weight of the slider will have little or no effect in breaking the teeth, or hindering its being done by the power applied in the longitudinal direction; but if one tooth is to be broken, it will be necessary to apply twice that power to break two, thrice the power to break three, &c. Hence it is evidently impossible to form any general rule concerning the friction which takes place on this principle. As experience, however, has shown that two bricks, or other bodies of that kind, are almost as easily drawn along a table when placed side by side, as when laid upon each other, it seems probable that such a locking of parts seldom occurs; and when it does, the obstacles are soon broken down. Yet it is certain, that some such thing must take place on all occasions, otherwise the wearing of bodies which rub upon one another could not happen.

From what has been said it must appear plain, that if a slider be laid upon an horizontal plane, it must remain at rest; though by a very small force, such as is barely sufficient to overcome the friction, it will be set in motion: because, on a plane quite horizontal, the motion of any body does not remove it in the least farther from the point to which it is attracted by the force of gravity. If the plane be inclined to the horizon, then, besides the power necessary to overcome the friction, it will be necessary to have one sufficient also to overcome that of gravity, by which it is determined to roll down the plane; the proportion of which is ascertained under Sect. II. § 4. The difficulty of raising great weights in this manner, however, where the ascent is steep, and the ways rough, must necessarily be so great, that sledges could not be used with any advantage, and therefore wheels are indispensable.

The advantage of wheels over sledges may be further understood from the following considerations. 1. A sledge, in sliding over a plane, suffers a friction equivalent to the distance through which it moves; but if we apply to it an axle, the circumference of which is six inches, and that of the wheels eighteen feet, it is plain, that moving the carriage eighteen feet over the plane, the wheels will make but one revolution; and as there is no sliding of parts between the plane and the wheels but only a mere change of surface, no friction can take place there, the whole being transferred to the nave acting on the axle, so that the only sliding of parts has been betwixt the inside of the nave and the axle; which, if they fit one another exactly, is no more than six inches: and hence it is plain, that the friction must be reduced in the proportion of one to thirty-six. Another advantage is also gained, by having the surfaces confined to such a small extent; by which means they may be more easily kept smooth, and fitted to each other. The only inconvenience is the height of the wheel, which must in all cases be added to that of the carriage itself.

It has been a matter of no little consideration, whether the wheels of a carriage ought to be small or large; and this subject Mr Antice has treated in a very particular manner. He observes, that in the overcoming of such obstacles as are commonly met with in roads, wheels act as mechanical powers, and therefore the size of the wheel must be regulated upon the

principles of these powers. Thus, let the circle O T A G L, fig. 71, represent a wheel of four feet diameter, placed on the level P Q, and opposed in that line by the obstacle O, which is supposed to be 7.03 inches in height; the line in which the carriage is drawn being C T, parallel to the plane P Q. In this case the effort applied to the carriage is communicated to the nave of the wheel where it touches the axle. This part, therefore, represents the part of the lever to which the power is applied, and is the point C in the figure. As the turning point is that where the wheel touches the obstacle, that must represent the fulcrum of the lever; whence that arm of the lever will be represented by CO, which may be supposed a spoke of the wheel: and as the upright spoke C L is in the line which bears the whole weight from the axle, and in which it is to be lifted; hence that part of the circumference of the wheel which is between the fulcrum and the upright spoke bearing on it, must represent the arm of the lever which is to raise the weight. In this case neither the weight nor the power act at right angles to their respective arms of the lever; so that we must represent their powers by the imaginary lines MO and ON. As the length of OM, therefore, is to that of ON; so is the proportion required to the weight to balance it on the obstacle, when rising over it; and in this case the arms are equal, it is plain that the powers must be so likewise. Every obstacle, therefore, exceeding this height, which is as 7.03 to 48, will require a power acting parallel to the plane greater than the weight drawn; and every obstacle whose height bears a smaller proportion to that of the nave, must be overcome by a smaller power.

Again, let a wheel of four feet diameter be represented by the circle in fig. 72, and supposed to be moved along the plane P Q, and an obstacle of twelve inches height be placed before it, the real lever will then be represented by the lines L O C; which being reduced to the imaginary ones MON, shows that the power is greater than the weight. By the same rule, if an obstacle of three inches be placed in the way of a wheel, as in fig. 73, the power required to move the wheel will be considerably less than the weight, though it is plain that the proportion of power must always be according to the size of the wheel, the height of the obstacle, and the direction in which the carriage is drawn. For instance, if the line of traction in fig. 73, be raised into the direction CS, the power required to move the carriage over it will be to the real weight as the line CO is to the line ON; and in consequence of thus altering the direction, we gain as much as the length of the line CO exceeds that of CN.

This view of the manner in which the wheels of carriages act, will serve to elucidate the question, whether large or small wheels are preferable for carriages? Let the circle fig. 74. represent a wheel of two feet diameter, and the obstacle in its way 7.03 inches in height; then will the true lever be represented by the lines COL, to be reduced to the imaginary ones MON. In this case, the power required to draw the carriage must be to its weight as NO is to OM, which is more than double; and thus the advantage of large wheels over small ones is evident. In this, however, as in all other cases, where wheels act as mechanical

Wheel-carriages.

431
whether
large or
small
wheels are
preferable.

Wheel-
carriages.

nical powers, we must remember, that the same doctrine applies to them as to the powers themselves when used in any other manner, viz. that as much as we gain in power we lose in time; and therefore, though a wheel of twice the diameter may be raised over an obstacle of any given height with twice the ease that would be required for one of once the diameter, yet the large wheel would require twice the time to move over it that the small one does.

Hitherto we have considered the carriage as being drawn in a direction parallel, or nearly so, to the plane on which the wheels move, which line is supposed to be horizontal; but the case will be different when we suppose them to move upon an inclined plane; for then, even though the line of traction be parallel to the ascending plane, and though the wheels act as levers, we shall find that the action of the weight will increase with the power gained by the increase of size in the wheels; and consequently, that the increased size of the latter will be of no farther use than that of diminishing the friction, in the same manner as is done upon horizontal planes.

To illustrate this, suppose the larger circle in fig. 75. to represent a wheel of four feet diameter, and the smaller circle a wheel of only two, both of which are made to ascend the inclined plane LM, by powers applied in the directions GI and ES parallel to the elevation of the plane, which is 45 degrees; it will then be found, that by describing the lever as in the former case, though the arm of the lever to which the power is applied be double the length in the large wheel that it is in the small, the other is augmented in the same proportion. Neither will the powers be augmented by varying the direction of the line of traction; for while these are kept parallel to one another, their relative powers must always keep the same proportion to one another. The reason is obvious, viz. that when wheels of any dimension ascend or descend inclined planes of any regular elevation, the fulcrum of the lever contained in the wheels must be determined by that part of the wheel which touches the plane, and which must always be of a proportionate height both in large and small wheels. It is otherwise, however, with the fulcrum marked out by perpendicular or irregular obstacles upon the plane itself; for large wheels will always have the advantage over small wheels when these are preferred, for the reasons already given. Indeed, when the wheel impinges perpendicularly upon an obstacle as high as the line of traction, it is plain that it cannot be drawn over it by any power whatever, unless the direction of the latter be altered.

From these considerations, our author draws the following conclusions: 1. That in a carriage placed upon an horizontal plane, nothing more is required to produce motion than to overcome the friction which takes place between it and the plane. 2. By the application of wheels to a carriage, the friction is lessened in the proportion of the diameters of the axles and hollow parts of the naves to those of the wheels. 3. In the draught of a carriage without wheels up a regular plain ascent, the friction must not only be overcome, but there is a power likewise to be applied sufficient to lift such a proportion of the weight of the carriage as the perpendicular part of the ascending plane bears to that portion of the plane. 4. If wheels of any size

44
General
conclusions
concerning
the motion
of carriages.

be applied to the carriage in such circumstances, they have only the advantage of lessening the friction; for though they really act as levers, yet as each arm of the lever is lengthened in proportion to the increase of size in the wheels, the power can be no farther augmented than as the ascent may act as a mechanical power for raising up the wheels, carriage, &c. to the top. 5. Large wheels have the advantage over small ones in overcoming obstacles, because they act as levers in proportion to their various sizes. 6. The line of traction, or that in the direction of which the carriage is drawn, should always, if possible, be parallel to that in which the plane lies; for when this is the case, the arm of the lever to which the power is applied will bear the longest proportion possible to the other. This always takes place when the line of traction is perpendicular to that spoke of the wheel which points to the obstacle. As it may not always be possible, however, to alter the direction of the line of traction to this position, it will be most proper to fix upon some medium betwixt that which commonly occurs and that which requires the greatest exertion to overcome the obstacle; that is, betwixt a level line and one rising perpendicular to the spoke of the wheel which points to the obstacle it is likely to meet with. The greater attention ought to be paid to this last, that all wheels, but especially small ones, are liable to sink into the ground over which they pass, and thus produce a constant obstacle to their own progress. The line of traction, it must also be observed, is not an imaginary one drawn from that part of the animal to which the traces or chains are attached to the axle of the wheel, but the real direction of the traces to whatever part of the carriage they are attached; for the effort will be instantly communicated in the same direction from one part of the carriage to all the rest, by reason of the whole being fastened together and in one piece.

Hitherto we have considered the whole weight of the carriages as bearing perpendicularly against the axles of the wheels: but as this cannot be done in chairs, carts, and other carriages having only two wheels, it will be necessary to have their centres, or transverse lines of gravity, as near to the ground as possible. To understand this, it must be premised, that the centre of gravity is that point of any body which if suspended will keep all the parts of the body at rest, let the body be placed in any situation we please. Thus the centre of gravity in a wheel or circle is the centre of the circumference, provided the substance of it be equally ponderous throughout. In like manner, the real centre of a globe coincides with the centre of gravity, provided the matter of which it is composed be equally ponderous. In a square, whether superficial or solid, the centre of gravity will be a point equally distant from all its sides; so that if the substance be equally heavy, it will be impossible to turn it into any position in which there will not be as much matter upon one side of the centre as upon the other: and in like manner, every figure, however irregular, has some point round which, if it be turned, as much matter will always be upon one side as on the other.

If now any body be supported by a transverse line passing not through the centre of gravity itself, but either

Wheel-
carriages.

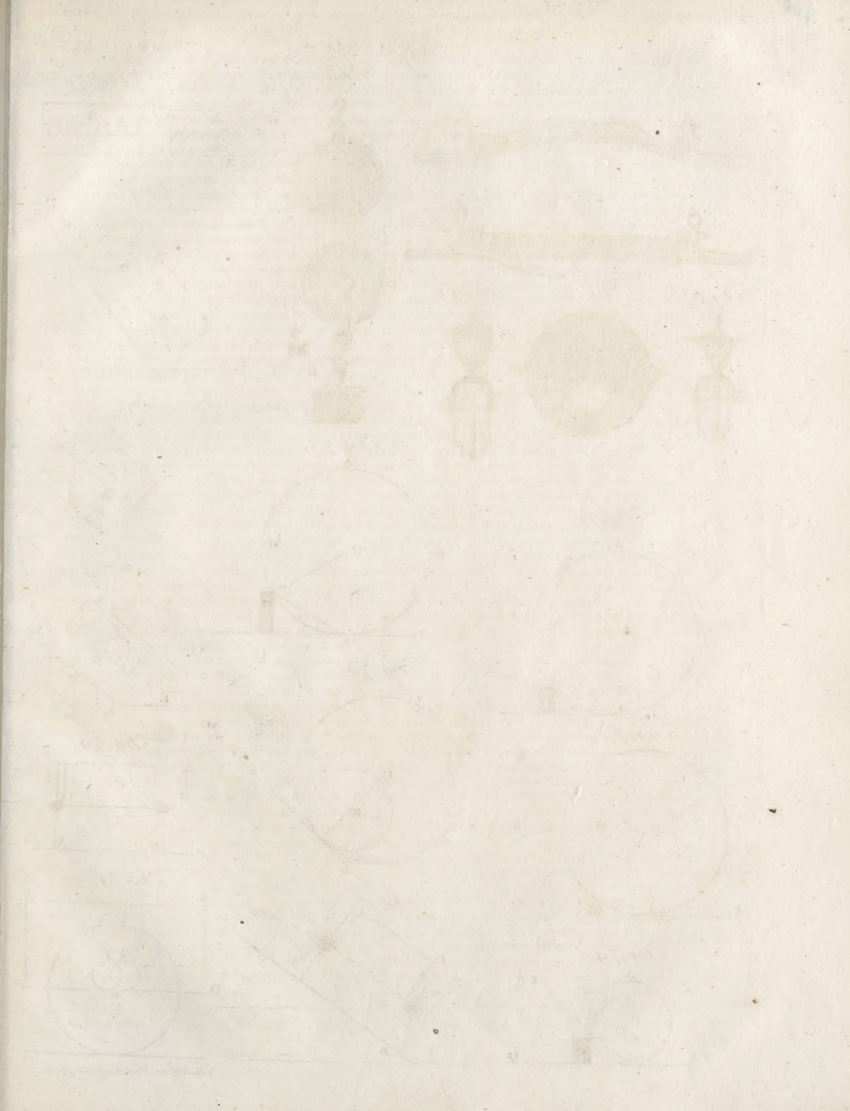


Fig. 63.



Fig. 64.



Fig. 67.



Fig. 65.

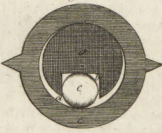


Fig. 66.



Fig. 68.



Fig. 69.

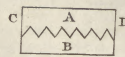


Fig. 70.

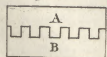


Fig. 78.

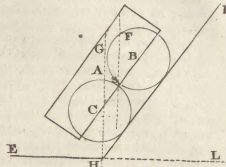


Fig. 72.

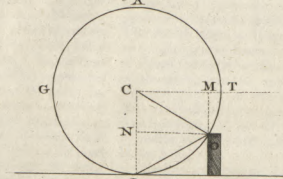


Fig. 77.

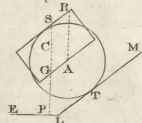


Fig. 76.

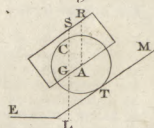


Fig. 71.

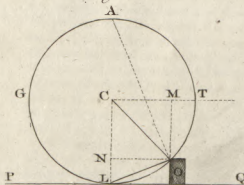


Fig. 75.

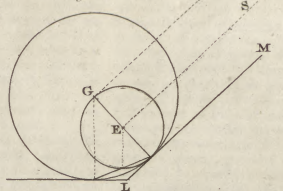


Fig. 73.

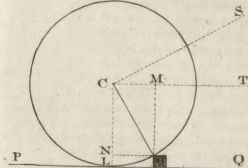


Fig. 79.

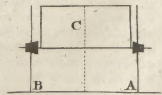


Fig. 74.

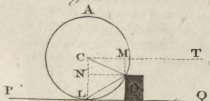


Fig. 80.

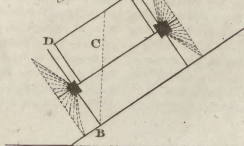
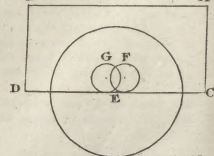


Fig. 81.



Wheel-carriages.

either above or below it, the body can only be kept in equipoise while that line remains directly above or below the point; for if the body is moved forwards, as in two-wheeled carriages moving down hill, a greater part of the weight will be thrown forwards over the line of suspension than what remains behind it; and consequently this superfluous part must be borne by the animal which draws it. In ascending any height, just the reverse takes place; for thus a portion of the weight is thrown backwards, and will tend to lift up the animal altogether. The consequence of this is, not only that the creature must proceed with great pain, but that the friction on the nave and axle will be augmented by laying upon them a part of the animal's weight also. If the body be suspended above the centre of gravity, the effect, though the same in the main, will be reversed in the ascent and descent of hill, as long as the body is firmly attached to the shafts; but should the whole weight be suspended under the axle, independent of the shafts altogether, then it will always, whether ascending, descending, or moving horizontally, have the same effect as if hung directly by it.

45.
Of suspending carriages above or below the centre of gravity.

Our author next proceeds to treat of a generally received opinion, that the disadvantages attending carriages suspended either above or below the centre of gravity are augmented by the height of the wheels. The reason given for this opinion is, that the hinder part of the load in ascending an hill, being thrown back, will overhang that part of a large wheel which touches the plane, much more than when a smaller wheel is used. Mr. Anllie, however, observes, that all the disadvantage, in either case, is expressed by the weight which, from its action upon the axle, tends to lift the animal, which must always be the same whether the wheels are high or low. Thus, in fig. 76. let a carriage be represented with two wheels of four feet diameter, ascending a plane of 35° elevation from the level L E. Let fig. 77. represent a carriage exactly in the same circumstances with the former, only that the wheels are six feet in diameter. Let C be the centre of gravity, and SP the line of gravity parallel to the central line AR, the line of support or suspension; in each of these the body is thrown so far back by its position, that the space GS and AR is taken from before the line of gravity, and added to the part behind it. Hence a certain part of the animal's weight must be exerted upon the shafts, in order to balance that of the carriage, which is thus thrown back, and which, as is evident from the figures, must be the same in both carriages, though the wheels of the one so much exceed those of the other in size, and the point T, where the wheel touches the plane, is much farther from the line of suspension in the large wheel than in the small one.

To remedy the inconvenience which must arise from placing the centre of gravity in the carriage low enough with respect to the wheels, it will be best to apply three or four wheels, placing them in such a manner that the line of gravity may always fall between the wheels, in whatever situation the carriage may probably be placed. Thus if the body A, fig. 78, be placed on four wheels, the axles of which are at B and C, it will be entirely supported between them, though more by C than B, even though the carriage

should be ascending an hill as steep as HI, viz. 50° degrees, which cannot ever happen in practice. Even in this case the animal would have no occasion to make exertions for preserving the balance of the carriage, though, had it been supported only by the axles of two wheels at S, far the greater part of the weight of the carriage would have been thrown behind, and the equilibrium could not have been preserved without the greatest difficulty. Hence it is plain, that the greater the distance betwixt the axles of three or four wheels applied to a carriage, the less liable will it be to have the line of gravity thrown out of its proper direction; but as this distance greatly augments the difficulty in turning a carriage, some medium is to be observed in this as well as other things.

What has been just now observed with regard to the preserving the balance of a carriage longitudinally, applies equally to the preventing it from being over-turned laterally upon uneven roads, or such as have one side much higher than the other. In order to this, we must take care to keep the line of gravity so far within the body of the carriage that it cannot be thrown out of it by any ordinary declivity of the road upon one side more than another. In the present case, however, as the wheels are not moveable on an axle in a lateral direction, we must consider the points of suspension to be those where the wheels touch the ground. Thus, let fig. 79. represent the cross section of a carriage moving upon two wheels; let C be its centre of gravity: it is plain, that in the position there represented, each of the points A and B sustains an equal share of the weight, and must do so as long as the carriage moves upon level ground: but if it be drawn along a road one side of which is higher than the other, such as is represented fig. 80. then the centre of gravity, and consequently the whole weight of the carriage, will bear upon the point of the wheel B, with this additional inconvenience, that the pressure does not lie perpendicularly but somewhat obliquely, by which the wheel is in great danger of being broken. To avoid inconveniences of this kind, the points of bearing upon the wheels are removed to a greater distance than the exact perpendicular, and this is called *diving* the wheels; the good effects of which are evident from the figure. The wheels are dished by inserting the spokes into the naves in such a manner that they may decline every way from the carriage. Some disadvantage, however, attends this contrivance, for the carriage thus takes up more room upon the road, which makes it more unmanageable; and when it moves upon plain ground, the spokes not only do not bear perpendicularly, by which means their strength is lessened, but the friction upon the nave and axle is made unequal, and the more so the more that the wheels are dished. To obviate these inconveniences, some have bent downwards the ends of the axles; but thus the good effects of the dish is entirely lost, for the wheels are thereby thrown erect, and the breadth of the dish doubly increased on the upper part of the carriage.

The practice of bending forward the ends of the axle is still worse; for thus the wheels are thrown out of that parallel direction which they should always preserve on the ground, and likewise increases the friction both on the shoulders of the axles, and like-

Wheel-carriages.

46
Of preventing a carriage from being over-turned.

Wheel-carriages.

wife on the ground; for the wheels, by rolling in this position, would soon come together if not prevented by the shoulders of the axles; whence in every revolution they must rub with considerable force upon the ground.

47
How the power of wheels may be augmented.

The power of wheels can only be augmented in two ways. 1. By increasing the length of that arm of the lever to which the power is applied; and, 2. By diminishing the friction betwixt the nave and axle. The former is only a temporary expedient in case of any obstacle which cannot be surmounted in the ordinary way. It is accomplished, by transferring the action of the animal's power from the centre to the upper part of the circumference of the wheel: thus the power of the lever will be nearly doubled, as is shown from fig. 71. for if the power be applied to the wheel at A, then the arm of the lever would be represented by the dotted line AO instead of CO; and the former being nearly twice as long as the latter, their powers must be in the same proportion. It is evident, however, that this mode of applying the animal's power can only be useful in any sudden emergency; for were we to attempt to reduce it into practice by winding a rope or chain about the circumference of the wheel, the animal must move twice as fast as the carriage. See this also exemplified in Plate CCLXXXV. fig. 58, where the moving power is represented by the weight P; the wheel EF turning between two toothed planes AB and CD. Here it is evident, that while one of the small divisions *ea*, *ac*, &c. moves forward its own length, the plane A must do the same, while the centre, by the motion of which only that of the wheel can be measured, moves but through half the space.

49
Of friction-wheels.

2. With respect to friction-wheels or rollers, the case is different; and we may apply these in as great numbers, and in as great a variety of ways as we please, without fear of inconvenience. The best method of applying them, according to Mr Anstice, is to have the wheels and axle fixed to one another, so that both may turn together. Two friction wheels a little overlapping each other, must then be fixed on each side of the body of the carriage, so that it may bear on the axle in the intersection of the wheels, as is represented in fig. 81. Here ABCD represents the body of the carriage, the large circle one of the wheels fixed to the axle E. The circumference of each of the friction-wheels F and G is supposed to be three feet, and that of their axles three inches. As the large wheel then revolves by the motion of the carriage, and thus transfers the friction from its circumference to its axle; so the friction of the axle itself is now transferred from the circumference of the friction-wheels to their axles. Every revolution of the great wheel, therefore, during which it passes over 18 feet of ground by means of the motion of the axle, puts the lesser wheels round one sixth part of their circle; and consequently their axles are moved through the same part of their circumference, the friction being thus reduced to that upon this small part; which being no more than half an inch, becomes 432 times less than it would have been on the large wheel without any motion on an axle, and 12 times less by means of the friction-wheels than without them. The axles on both sides indeed are in motion, but the calculation must be made as if only one moved; for the greater number of wheels

there are, the more will the friction be divided among them.

An objection of considerable weight arises to this method of fixing the wheels and axles together, that thus the wheels are prevented from moving with different velocities as they ought to do, when the carriage moves out of a right line; but this may be obviated by leaving the friction wheels loose upon their axles, by which means they will be at liberty to move with different velocities, at the same time that they will have the advantages of friction-wheels always as to one wheel of the carriage, and generally as to both.—The whole contrivance, however, seems likely to be entirely superseded by the following one of Mr Gamett of Bristol, who has obtained a patent for it. The general principle on which he proceeds is this. Between the axle and nave a hollow space is left to be filled up by solid equal rollers nearly touching each other. These are furnished with axles inserted into a circular ring at each end, by which their relative distances are preserved; and they are kept parallel by means of wires fastened to the rings between the rollers, and which are rivetted to them.

To understand the effect of this machinery we must consider, that if, when plane surfaces move with a roller between them, if the under one be fixed, the upper plane will put the rollers forward but with half the quantity of its own motion. This is owing to the reaction of the stationary plane, which causes the roller to move backward upon itself as much as the other causes it to move forward upon itself. Thus, let CD, fig. 82. be a fixed surface, and AB a moveable one, with a roller E between them; if B be moved forward to G, it will cause the roller to move to F, which is but half the distance that AB has moved; because it has rolled in a retrograde direction as far against the surface BA as it has gone forward upon the other. This is entirely owing to the resistance it meets with from CD; for if it did not touch that surface, but was attached by any other means to AB, it would be carried along with it through the whole space without any rolling motion. Hence it is clear, that if a roller be placed between the axle and nave of a wheel, and the latter be turned round, the roller will move with a retrograde motion upon the axle; and in order to carry it quite round, the nave must be turned as much beyond a whole revolution as is equal on its inner circumference to the whole circumference of the axle. To exemplify this, let ABCD, fig. 83. represent the nave of the wheel E, the inner circumference of which is 18 inches, and the axle so small that it may be considered as a point. Let F and G be two rollers closely fitted between them: if then the wheel be turned round, the rollers will also be carried along with it round the point which we consider as an axle; for there can neither be rolling nor friction against a mere point. But if the axle be of any sensible size, for instance one inch circumference, then must each roller move round by the motion of the nave against it, and the resistance of the angle on the opposite side. But in order to do this, it must roll in a retrograde direction upon the nave, and consequently the latter must go as far beyond a revolution as is equal to the circumference of the axle upon it, before the roller can go once round the axle, which in this case is by

Plate
CCLXXXVIII

Plate
CCLXXXV.

Wheel-carriages.

one 18th part of the circumference. Should the circumference of the axle be nine inches, and that of the inner part of the nave remain as before, the wheel must perform one revolution and an half before the roller could be moved once round, and so on in the same proportion : but as the circumference of an axle must always be less than the inner part of a nave turning upon it with rollers between them, it never can amount to two revolutions of the wheel round the axle, however nearly it may approach to it ; for no segment of a circle can ever be a straight line.

It will now be apparent, that if several rollers be placed all round between the nave and axle, whichever way the wheel be turned there cannot be any real friction, but merely a rolling of the rollers. If likewise these rollers be all of one size, and very nicely fitted to the cavity, they will keep their places without shifting, and very effectually answer the purpose of destroying friction. As such rollers, however, were very liable to be displaced by accident, the use of them was neglected, till Mr Gamett suggested the improvement already mentioned, and which is represented in fig. 84. Here ABCD represents a piece of metal to be inserted into the nave of a wheel, of which E is the axle, and 1, 1, 1, &c. rollers of metal having axes inserted into the brazen circle which passes thro' their centres ; and both circles being rivetted together by means of bolts passing between the rollers from one side of the nave to the other ; and thus they are always kept separate and parallel. By this method, indeed, some friction unavoidably takes place betwixt the axles of the rollers and their sockets in the brass-rings ; but as the quantity of friction depends principally on the force by which the rubbing surfaces are pressed upon each other, and as in this case there is but the slight pressure occasioned by those accidental circumstances which would bring the rollers together, the friction must be too trifling to be noticed.

Thus far with regard to wheel-carriages in general. We must now make some remarks on the methods of drawing them, and the construction of particular carriages.—Men, by reason of their upright form, are by no means fitted for horizontal draughts ; but animals who go upon all fours are remarkably so. In Britain horses are commonly made use of ; but mules, oxen, sheep, and dogs, in other parts of the world. In all animals, however, the capacity for drawing a load depends upon their weight as well as their absolute strength. Thus it may happen, that a very heavy horse will draw a load, which a lighter though stronger one could not move ; and this will always happen, when the weaker horse exceeds the other in weight more than he is exceeded by him in strength. It is well known that the weight, as far as it goes, reacts upon the horse, and pulls him back as much as he pulls it forward, until the exertions of the muscles of the animal resisted, by the solid ground, overcome the resistance of the load upon the moveable wheels, and it goes forward in proportion to the excess of the one power over the other. If the horse were put upon a moveable plane, and attempted to draw a load upon the solid ground, instead of pulling it forward he would pull himself back. The horse has two sources of power in drawing a load, viz. his strength and

weight. The former is the source of velocity ; and as we find the actual power of any inanimate body in motion by multiplying the velocity into its quantity of matter, so do we find the power of a horse to draw a load, by considering his weight as well as absolute strength. There are even many instances in common practice, where it is useful to increase the weight of an horse or other animal ; and therefore when horses are employed to draw mills, it is usual to put a small load upon their backs in order to increase their absolute momentum. Where the animals are equal in strength and momentum, however, the only difference that can take place in the weights they draw must arise from the convenience or inconvenience of the carriages to which they are yoked, or of the roads upon which they walk. A load breast-high is much more easily drawn than one which is dragged along the ground, because the power of the animal is then exerted directly against it ; and this holds good whether the horses go up or down hill. In descending, indeed, as the load is then higher with regard to the horse than when it is on a plane, he will consequently pull it with the greater force ; but in this case, its own gravity conspires with the draught, and will likewise help the load to descend ; so that in this case the animal has an opportunity of exerting his greatest power when there is the least necessity, nay, when it is often inconvenient.

In all carriages with four wheels the two fore ones are made of a much smaller size than the hind ones, both for the sake of turning more easily, and likewise that there may be no danger of cutting the braces ; but were both the fore and hind wheels to be of the same height, the carriage would be drawn with much greater ease. It is imagined indeed by the drivers of carriages, that the high hind wheels push on the fore-wheels ; but this is evidently absurd ; for the fore-wheels must turn as many times round oftener than the large ones as the latter exceed them in size. Thus, if we suppose the circumference of the large wheels to be 18 feet, and that of the small ones only six, it is evident that the latter must turn round three times for once that the large ones turn round. Supposing the carriage therefore to be loaded equally on both axles, it is plain that by the greater friction upon the fore-axle than the other, it must wear out much sooner, and that as much as the fore-wheels are smaller than the hind ones. But it is the universal practice of those conversant in loading and driving carriages, to put a much greater load upon the fore than the back axle. Thus the friction not only becomes greatest where it ought to be least, but the small wheels must necessarily sink deeper into the ground than the large ones, which they are at any rate inclined to do from their size. The only danger in laying the greatest load upon the hind axle is, when the carriage goes up a very steep ascent ; but in the few cases in which this may happen, a small temporary weight laid upon the pole betwixt the horses would prevent all danger of overfetting.

To confirm these reasonings by experiment, let a small model of a waggon be made, with its fore-wheels $2\frac{1}{2}$ inches in diameter, and its hind-wheels 4 ; the whole model weighing about 20 ounces. Let this little carriage be loaded any how with weights, and have a

Wheel-carriages.

Wheel-carriages.

small cord tied to each of its ends, equally high from the ground it rests upon; and let it be drawn along a horizontal board, first by a weight in a scale hung to the cord at the fore-part; the cord going over a pulley at the end of the board to facilitate the draught, and the weight just sufficient to draw it along. Then turn the carriage, and hang the scale and weight to the hind-cord, and it will be found to move along with the same velocity as at first: which shows that the power required to draw the carriage is all the same, whether the great or small wheels are foremost; and therefore the great wheels do not help in the least to push on the small wheels in the road.

Hang the scale to the fore-cord, and place the fore-wheels (which are the small ones) in two holes, cut three eighth parts of an inch deep in the board; then put a weight of 32 ounces into the carriage over the fore-axle, and an equal weight over the hind-one: this done, put 44 ounces into the scale, which will be just sufficient to draw out the fore-wheels: but if this weight be taken out of the scale, and one of 16 ounces put into its place, if the hind-wheels are placed in the holes, the 16 ounce weight will draw them out; which is little more than a third part of what was necessary to draw out the fore-wheels. This shows, that the larger the wheels are, the less power will draw the carriage, especially on rough ground.

Put 64 ounces over the axle of the hind-wheels, and 32 over the axle of the fore-ones, in the carriage; and place the fore-wheels in the holes: then put 38 ounces into the scale, which will just draw out the fore-wheels; and when the hind-ones come to the hole, they will find but very little resistance, because they sink but a little way into it.

But shift the weights in the carriage, by putting the 32 ounces upon the hind-axle, and the 64 ounces upon the fore-one; and place the fore-wheels in the holes: then, if 76 ounces be put into the scale, it will be found no more than sufficient to draw out these wheels; which is double the power required to draw them out when the lighter part of the load was put upon them; which is a plain demonstration of the absurdity of putting the heaviest part of the load in the fore-part of the waggon.

Every one knows what an outcry was made by the generality, if not the whole body, of the carriers, against the broad-wheel act; and how hard it was to persuade them to comply with it, even though the government allowed them to draw with more horses, and carry greater loads than usual. Their principal objection was, that as a broad wheel must touch the ground in a great many more points than a narrow wheel, the friction must of course be just so much the greater; and consequently there must be so many more horses than usual to draw the waggon. It is believed that the majority of people were of the same opinion; not considering, that if the whole weight of the waggon and load in it bears upon a great many points, each sustains a proportionably less degree of weight and friction, than when it bears only upon a few points: so that what is wanting in one is made up in the other; and therefore will be just equal under equal degrees of weight, as may be shown by the following plain and easy experiment.

Let one end of a piece of pack-thread be fastened

to a brick, and the other end to a common scale for holding weights: then, having laid the brick edgewise on a table, and let the scale hang under the edge of the table, put as much weight into the scale as will just draw the brick along the table. Then taking back the brick to its former place, lay it flat on the table, and leave it to be acted upon by the same weight in the scale as before, which will draw it along with the same ease as when it lay upon its edge. In the former case, the brick may be considered as a narrow wheel on the ground; and in the latter, as a broad wheel. And since the brick is drawn along with equal ease, whether its broad side or narrow edge touches the table, it shows that a broad wheel might be drawn along the ground with the same ease as a narrow one (supposing them equally heavy), even though they should drag, and not roll, as they go along.

As narrow wheels are constantly sinking into the road, they not only prove very destructive to the highways over which the carriages move, but by reason of this very sinking, they must be accounted as going continually up hill in some degree, even when drawn upon plain ground. These inconveniences are obviated by the use of broad wheels; and indeed the utility of these is so obvious, that it seems surprising how the use of narrow wheels is on any occasion permitted by the legislature. The wheels ordinarily used for waggons are nine inches broad; but of late a practice has been introduced of using rollers 16 inches broad; by which the inconveniences of the narrow wheels are removed, and the greatest weights may be drawn over the very worst roads, not only without making them worse, but greatly to their improvement. It has been objected, that broad wheels soon accumulate in clayey roads so much matter that it would soon equal an ordinary load; but, not to mention that such roads ought to have no existence in a country where such sums are annually paid for their reparation, it is evident, that passing heavy rollers over them is the only method to give that firmness to clay which is necessary for its supporting the animals who walk over it; and indeed many of the roads in this country, by reason of the continual poaching by wheels and feet of horses, &c. become throughout a great part of the year almost impassable by people on foot. The legislature appear to be very sensible of the advantages derived from these rollers, and accordingly allow such carriages as are furnished with them to go toll-free.

In the transactions of the Royal Irish Academy for 1788, we meet with some curious observations on the subject of wheel-carriages, by Mr Lovell Edgeworth. This gentleman informs us, that he was present in London in 1773, at a set of experiments tried in order to determine the comparative advantages of low and high wheels. The apparatus for these experiments was constructed with the greatest accuracy. The carriages themselves were made by the best workmen in London, and they were drawn along a smooth table by silk strings of small diameters put over a pulley nicely constructed, and fitted up in such a manner as to have scarce any friction. On applying a weight to the end of the string which passed over the pulley, little difference appeared in the velocities with which the carriages passed along the table, whether the wheels were high or low; but what appeared surprising was, that when obstacles were put

Wheel-carriages.

so
Of broad and narrow wheels,

Mr Edgeworth's experiments on carriages.

Fig. 82.

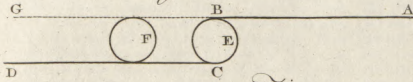


Fig. 86.

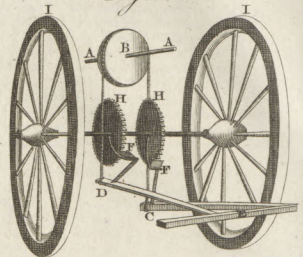


Fig. 83.

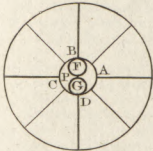


Fig. 85.



Fig. 87.



Fig. 84.

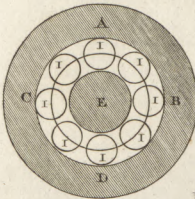


Fig. 88.

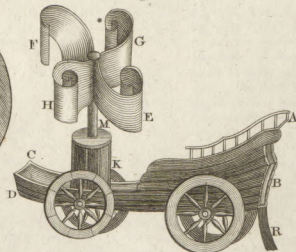


Fig. 89.

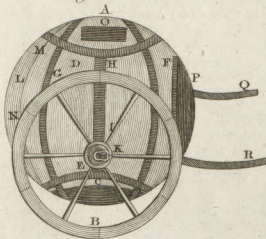
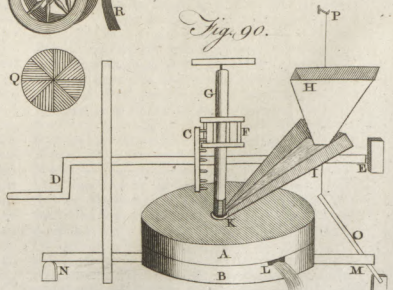


Fig. 90.



Wheel-carriages.

Wheel-carriages.

in their way, sometimes the high and sometimes the low wheels had the advantage, according to the different shapes and sizes of the obstacles. "It appears at first view (says Mr Lovell), that the force which drew these carriages was employed only in overcoming the friction of the axle-tree, or in lifting the weight over the obstacle. But I suspected at the time, and have since been convinced, that an obstruction of another sort existed more considerable than either of these which I have mentioned, and which has not to my knowledge been taken notice of by any writer upon mechanics."

52
Supposed to be independent of gravity.

This obstruction is no other than the *vis inertia* of matter, which has so much engaged the attention of philosophers, and the non-entity of which, in distinction from the power of gravity, seems now to be pretty generally admitted. The argument used for its existence by Mr Edgeworth is as follows: "After a carriage has been once set in motion upon a smooth road with any given velocity, its motion, so long as that velocity is continued, is neither retarded nor promoted by the *vis inertia*; but whenever it passes over any height, not only the weight of the carriage must be lifted up, but the *vis inertia* of that weight must be overcome in a new direction; and as much velocity must be communicated to it in that new direction as will enable it to rise to the height of the obstacle while it passes over its base. When an obstacle is of such a size and shape that a wheel of six feet diameter must strike the top of it at once, and not roll from the bottom upwards, and when its shape will permit a smaller wheel to touch it during its whole ascent, as there is more time allowed for overcoming the *vis inertia* of its weight in the latter case than in the former, the smaller wheel may be drawn forward by a less power than the larger, notwithstanding the advantage of a lever, which is in favour of the larger wheel."

To determine this, our author made use of an inclined plane five or six feet long and one foot high, placed on a smooth horizontal floor. He then assumed the distance to which the carriage was driven on the floor by the velocity acquired in descending the plane, as a measure of the force with which it could overcome any obstacle placed in its way; and consequently the diminution of the distance was the measure of the resistance itself. Not satisfied with this apparatus, however, he screwed a circle of iron three feet three inches in diameter upon a solid floor. In the centre of this circle he erected an upright axis or roller upon two pivots, one resting in a socket of brass upon the floor, the other in a bridge raised across the machine. Around the axis was wound a small silk cord, with a scale and weights fastened to it, which passed over a pulley into an adjoining stair-case, and turned the axis with a determined velocity. An horizontal arm of wood extended from the axis to the circumference of the inner circle, and to the extremity of the arm was fastened a piece of steel in form of the axle-tree of a carriage, having a wheel upon it, which by the motion of the axis was carried round upon its edge like the stone of a tanner's mill. The arm was furnished with an hinge, by means of which the wheel could rise up and pass over any obstacle which stood in its way. Above this was another arm, having on its extremity

a tin vane, which by its resistance to the air regulated the motion of the machine. On putting weights into the scale, it was found that eight or ten turns were necessary to give the wheel an uniform velocity, which was preserved in all the experiments, any resistance thrown in the way being overcome by an addition of weight, and consequently this addition being always an accurate measure of the resistance.

On loading the wheel so as to weigh about four pounds, it acquired a velocity of ten feet in a second by nearly five pounds and an half; but on placing in its way an obstacle only a quarter of an inch high, six pounds and an half were required to cause the wheel pass over it. Two such obstacles required fourteen and an half pounds; but on substituting two obstacles of the same height, but making an inclined plane three quarters of an inch long, it required only two pounds to overcome their resistance. "The difference therefore (says he) between two and fourteen, must be attributed to the *vis inertia*; for the velocities of the carriage and the heights of the obstacles remaining the same, the only difference that exists is, that in the one case the wheel has much more time to surmount the obstacle, than in the other, and consequently had much less *vis inertia*."

On this piece of reasoning, however, it is impossible to avoid making the following remark, *viz.* that nothing happens but what ought to do so upon the common principles of mechanics. One obstacle, when upright, required six pounds and an half to overcome it; but when an inclined plane three times the length was added to it, it ought then to have been overcome by a third part of the power, that is, by something more than two pounds; and the reason why something less than the third part was required, seems to have been the advantage the wheel had by acting as a lever; as has been already observed on the principles of Mr Amont. There is not therefore the least occasion to apply to a *vis inertia*, or any obscure principle, for a solution of what may so easily be solved upon the common principles of mechanics and gravity.

Mr Edgeworth concludes his observations with some remarks on the use of springs, which are found greatly to facilitate the draught of carriages. "Whatever (says he) permits the load to rise gradually over an obstacle without obstructing the velocity of the carriage, will tend to facilitate its draught; and the application of springs has this effect to a very considerable degree: the same weight of four pounds being drawn over the same obstacles, when springs were put between the load and the carriage, by four pounds instead of 14. This remarkable difference points out the great advantage of springs in rough roads; an advantage which might be obtained for heavy waggons, as well as for other carriages, by a judicious application of the same means.

53
Use of springs in carriages.

"It appears from the Memoirs of the French academy, that the idea of applying springs to carriages had occurred to M. Thomas in the year 1703; who has given a drawing of a carriage constructed upon this principle many years before it was attempted to be put in execution. So little expectation had he of success, that he expressly mentions it as a theory which could not be reduced to practice: he had, however, no notion of applying springs to facilitate the draught,

but

Wheel-carriages.

but merely for the convenience of the rider; and I apprehend that it is not at present commonly imagined that springs are advantageous for this purpose; nor would it at first sight appear credible, that, upon a rough paved road, such as are common in Cheshire and other parts of England, a pair of horses could draw a carriage mounted upon springs with greater ease and expedition than four could draw the same carriage if the springs and braces were removed, and the carriage bolted fast down to the perch."

54 On high and low carriages.

Mr Lovell made also some experiments with high and low, long and short, carriages, in order to determine which was the most advantageous, but could not recollect the particular results of each experiment. He was, however, assured, that the preference lately given in England to high carriages is ill-founded; and that, though in smooth roads, the height of the carriage is a matter of indifference, yet in rough roads it is very disadvantageous. The length of carriages also, if their weight be not increased, is a matter of indifference, except in very uneven roads, and where there are deep ruts; long carriages being preferable in the former case, and short ones in the latter.

The reason why springs so much facilitate the draught of carriages seems to be, not only that they allow the wheels to pass more gradually over the obstacles, as Mr Edgeworth says, but that by their elasticity they make the carriage bound upwards every moment for a small way. Thus its gravity is for that moment in a great measure counteracted, and the progressive motion which it has already acquired is at liberty to act more freely in pushing it forward; for were it possible very suddenly to take away the horses from a carriage mounted on springs, and moving with considerable velocity, it would continue for some time to move of itself; the weight in this case acting as a fly upon any mechanical engine, by means of which the machine accumulates a certain quantity of power, and will keep itself in motion for a considerable time after the hand is taken away from it. The weight of all carriages indeed has some effect of this kind, otherwise the draught would require an intolerable exertion of strength; and it is to be observed, that this tendency to proceed in the direction in which it is once set a-going, is remarkable in all great quantities of matter, and very perceptible even when weights are pulled directly upward; for in raising great weights by a crane, the burden is lifted with considerably more ease when near the top than at bottom, even after making every necessary allowance for the weight of the rope, &c.

55 A carriage to go without horses, or any other force than what it receives from the passengers. Fig. 85.

By means of wheels, some people have contrived carriages to go without horses, or any other moving power than what was given by the passengers, by the wind, &c. One of these is represented by ABCD. It is moved by the footman behind it; and the forewheels, which act as a rudder, are guided by the person who sits in the carriage (A).

Between the hind-wheels is placed a box, in which is concealed the machinery that moves the carriage. AA (fig. 86.) is a small axis fixed into the box. B is a pulley, over which runs a rope, whose two ends are

fastened to the ends of the two levers or treddles CD, whose other ends are fixed in such manner in the piece E, which is joined to the box, that they can easily move up and down. F, F, are two flat pieces of iron that are joined to the treddles, and take the teeth of the two wheels H, H, which are fixed on the same axis with the hind-wheels of the carriage, I, I.

Wheel-carriages.

It is evident, that when the footman behind presses down one of the treddles, suppose C, with his foot, he must bring down one of the pieces of iron F, and consequently turn the wheel H that is next to it; and at the same time, by means of the rope that goes over the pulley, he must raise the other treddle D, together with its piece F, which being thrust down will turn the other wheel H; and so alternately: and as the great wheels are fixed on the same axis, they must necessarily move at the same time.

It is easy to conceive, that if the ends of the treddles next E, instead of being placed behind the carriage, were turned the opposite way, so as to come under the feet of the person who sits in it, he might move it with equal, or even greater facility, than the footman, as it would then be charged with the weight of one person only.

A machine of this kind will afford a salutary recreation in a garden or park, or on any plain ground; but in a rough or deep road must be attended with more pain than pleasure.

Another contrivance for being carried without To fail as draught, is by means of a sailing chariot or boat fixed fast, with a fair wind, on four wheels, as AB; which is driven before the fair wind, by the sails CD, and guided by the rudder E, by land, as by water. In a chariot of this kind, the wheels should be farther Fig. 87. afunder, and the axle-trees longer, than in other carriages, to prevent overturning.

A machine of this sort was constructed in the last century by Stephanus, at Scheveling in Holland, and is celebrated by many writers. Its velocity with a strong wind is said to be so great, that it would carry eight or ten persons from Scheveling to Putten, which is 42 English miles distant, in two hours.

Carriages of this kind are said to be frequent in China; and in any wide, level country, must be sometimes both pleasant and profitable. The great inconvenience attending this machine is, that it can only go in the direction the wind blows, and even not then unless it blow strong: so that, after you have got some way on your journey, if the wind should fail, or change, you must either proceed on foot or go back. Some remedy for this inconvenience will be found in the next contrivance. The Hollanders have, or had, small vessels, something of this kind, that carry one or two persons on the ice, having a sledge at bottom instead of wheels: and being made in the form of a boat, if the ice break the passengers are secured from drowning.

To fail against the wind: Let ABCD be the body of a failing chariot: M the mast, to which are fixed the wings or sails EFGH; the two frith of which, EF, the wind are here supposed to be expanded by the wind; R is the rudder by which it is guided. Therefore the wind driving To fail by land against the wind. Fig. 88.

(A) This machine was invented by M. Richard, a physician of Rochelle, and was exhibited at Paris in the last century. It is described by M. Ozanam in his *Recreations Mathematiques*.

Fig. 92.



Fig. 99.



Fig. 93.



Fig. 91.

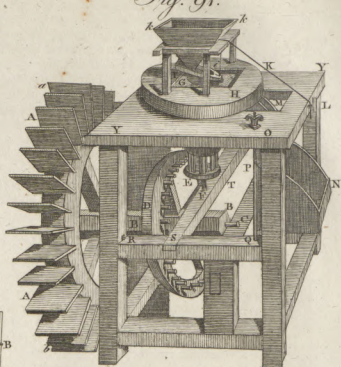


Fig. 94.

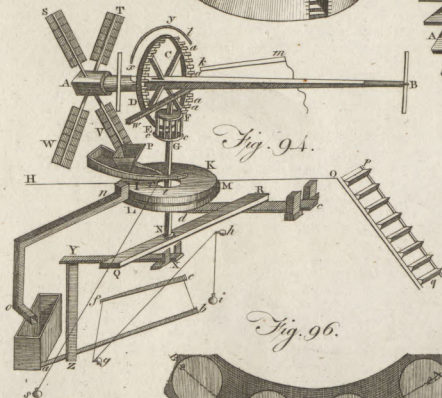


Fig. 96.

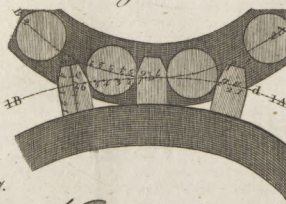


Fig. 100.



Fig. 97.



Fig. 95.

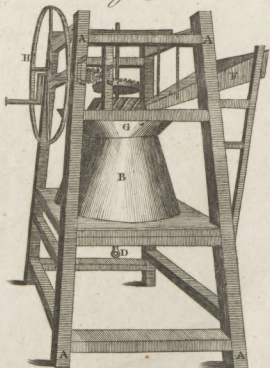
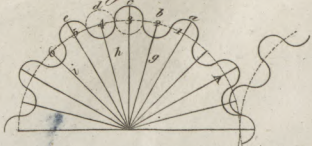


Fig. 98.



Wheel
carriages.

Wheel-
carriages.

driving the sails round, with the mast M, and the cog-wheel K, take the teeth placed perpendicular to the sides of the two fore-wheels of the carriage, and consequently keep it in continual motion.

The body of this machine should not be large, nor placed very high, not only to prevent overturning, but that its motion may not be thereby impeded; for the velocity will be in proportion to the force of the wind on the sails to that on the body of the machine. Therefore, if they be both equal, it will stand still; or if the force on the body be greatest, it will go backwards; unless there be a contrivance to lock the wheels. The upper part of the machine next A, may be made to take off when the wind is contrary; and there may be another set of sails placed between the two hind-wheels, which will considerably increase its velocity. But after all, for general use, a common carriage must be preferable: for this cannot be expected to go up a moderate ascent without great difficulty; nor down a declivity, when there is a strong wind, without danger; and even on level ground, if the road be in any degree rough, its progress must be very slow, attended both with difficulty and danger. In an open country, however, where there is a large tract of level and smooth ground, and frequent strong winds, a machine of this sort will certainly be very convenient; and in most countries, when made of a small size, may be useful to young people, by affording them a pleasant and healthful exercise.

58
The un-
invertible car-
riage.
fig. 89.

A carriage, the body of which is incapable of being overturned, may be made as follows. The body must consist of a regular hollow globe, as AB, at the bottom of which is to be an immovable weight, and which must be proportioned to the number of persons or the load the machine is intended to carry. Round the globe must go two horizontal iron circles D, E, and two others F, G, that are perpendicular to the former. All these circles must be made exactly to fit the globe, that it may move freely in every direction. The two horizontal circles are to be joined on each side by a perpendicular bar, one of which is expressed in the figure by HI. All these irons should be lined with leather, to prevent unnecessary friction. The body of the carriage may be either of leather or hard wood; but the latter will be most eligible, as least liable to wear. The wheel on each side is to be fastened to the perpendicular bar by means of a handle K that keeps it steady.

Now the body of this machine moving freely in the iron circles every way, the centre of gravity will always lie at C; therefore, in whatever position the wheels are, or even if they overturn, the body of the carriage will constantly remain in the same perpendicular direction.

At L is placed a pin, round which is a hollow moveable cylinder: this pin moves up and down in the groove MN, that it may not impede the perpendicular motion of the circles, at the same time that it prevents the body of the machine from turning round in a horizontal direction. O is one of the windows, P the door, and QR the shafts to this machine.

When a carriage of this sort is intended for a single person, or a light weight, it may be hung on swivels, in the same manner as the rolling lamp or the sea-com-

pafs, which will make its horizontal motion still more regular: and when it is designed to carry several persons, by adding another perpendicular bar on each side, between the two horizontal circles, it may be placed on four wheels. The body of this machine should be frequently oiled or greased, not only to prevent any disagreeable noise that may arise from its rubbing against the circles, but to prevent unnecessary wear in the several parts.

This carriage is not intended for smooth roads, or a regular pavement; there certainly, those of the common construction are much preferable; nor should a carriage totally free from irregular motion be sought after by those who are in perfect health: but there are many persons, subject to different disorders, who by being obliged to travel over rough roads in the common carriages, suffer tortures of which the healthful have no idea; to all these, therefore, and to every one who is forced to travel through dangerous roads, a carriage of this sort must doubtless be highly desirable.

As this design may appear to some persons, on a superficial view, impracticable, we shall here insert an account of a similar carriage, which we have taken from the first volume of the *Abridgement of the Philosophical Transactions*, by Lowthorp. There is not, however, any description of the manner in which that machine was constructed. The account is as follows: "A new sort of calash described by Sir R. B. This calash goes on two wheels; carries one person; is light enough. Though it hangs not on braces, yet it is easier than the common coach. A common coach will overturn if one wheel go on a superficies a foot and a half higher than the other; but this will admit of the difference of three feet and one-third in height of the superficies, without danger of overturning. We chose all the irregular banks, and sides of ditches, to run over; and I have this day seen it, at five several times, turn over and over, and the horse not at all disordered. If the horse should be in the least unruly, with the help of one pin you disengage him from the calash without any inconvenience (*a contrivance of this sort may be easily added to the foregoing design*). I myself have been once overturned, and knew it not till I looked up and saw the wheel flat over my head: and if a man went with his eyes shut, he would imagine himself in the most smooth way, though at the same time there be three feet difference in the height of the ground of each wheel."

SECT. V. Of Mills.

MILL, in the proper sense of the word, signifies a machine for grinding corn, though, in a more general sense, it is applied to all machines which have an horizontal circulatory motion. Mills are distinguished by particular names, sometimes taken from the powers by which they are moved, and sometimes from the uses to which they are applied. Hence they are called hand-mills, horse-mills, water-mills, fulling-mills, wind-mills, corn-mills, levigating mills, boring-mills, &c.

The most simple of these is the *hand mill*, represented fig. 90, where A and B represent the two stones between which the corn is ground, and of which the upper one A turns round, but the lower one (B) remains

59
A hand-
mill.

Mills.

mains fixed and immovable. The upper stone is five inches thick, and 21 inches broad; the lower one somewhat broader. C is a cog-wheel, having 16 or 18 cogs, which go into the trundle F, having nine spokes fixed to the axis G, the latter being firmly inserted into the upper stone A, by means of a piece of iron. H is the hopper into which the corn is put; I the shoe to carry it by little and little through a hole at K, in betwixt the stones, where being ground into meal, it comes out through the eye at L. Both stones are inclosed in a circular wooden case, of such a size as will admit the upper one to run freely within it.—The under surface of the upper stone is cut into grooves, as represented at Q, which enable it to throw the meal out at the eye L more perfectly than could be done if it was quite plain. Neither of them are entirely flat, the upper one being somewhat concave, and the under one convex. They nearly touch at the edges, but are at some distance in the middle, in order to let the corn go in between them. The under stone is supported by strong beams, not represented in the figure; the spindle G stands on the beam MN, which lies upon the bearer O. One end of this bearer rests upon a fixed beam, and the other has a string fixed to it, and going round the pin P, by the turning of which the timbers O and MN may be raised or lowered, and thus the stones put nearer, or removed farther from each other, in order to grind fine or coarse. When the corn is to be ground, it must be put into the hopper by little at a time. A man turns the handle D, and thus the cog-wheel and trundle are carried round also together with the stone A. The axis G is angular at K; and, as it goes round, shakes the shoe I, and makes the corn fall gradually through the hole K. The upper stone going round grinds it, throwing out the meal, as already said, at the eye L. Another handle, if thought proper, may be put at the other end of the handle E. The spindle must go through both stones, in order to reach the beam MN, and the hole through which it passes is fastened with leather or wood, so that no meal can pass through. Mr Emerfon, from whom this account is taken, observes, that “it is a pity some such mills are not made at a cheap rate, for the sake of the poor, who are much distressed by the roguery of the millers.”

60
Horse-mill.

The construction of a horse-mill differs not from that of the hand-mill just described, excepting that instead of the handle D, the spindle is furnished with a long horizontal lever and cogged wheel, which turns the trundle and stones, as already mentioned.—The stones are much heavier than in the hand-mill.

61
Water-mills.

The mills most commonly in use for grinding corn are water-mills, the construction of which is not essentially different from that of the hand or horse-mills.—The lower mill-stone, as already mentioned, is fixed, but the upper one moveable upon a spindle. The opposite surfaces of the two stones are not flat, but the one convex and the other concave, though in a very small degree. The upper stone, which is six feet in diameter, is hollowed only about an inch in the middle, and the other rises three quarters of an inch. They approach much nearer each other at the circumference, and the corn begins to be ground about two thirds of the radius distant from the circumference, and there it makes the greatest resistance, the space between the

N° 199.

two stones being in that place only about two-thirds or three-fourths of the thickness of a grain of corn; but as these stones, as well as those of the hand-mill or horse-mill, can be separated a little from each other, the meal may be made fine or coarse in them, as well as in the two former mills.

In order to cut and grind the corn, both the upper and under stones have furrows cut in them, as is observed in the hand-mill. These are cut perpendicularly on one side, and obliquely upon the other, by which means each furrow has a sharp edge, and by the turning of the stones, the furrows meet like a pair of scissars, and by cutting the corn, make it grind the more easily. They are cut the same way in both stones when they lie upon their backs, by which means they run crosswise to each other when the upper one is inverted and turned round; and this greatly promotes the grinding of the corn, great part of which would be driven onward in the lower furrows, without being ground at all, if both lay the same way.—When the furrow becomes blunt and shallow by wearing, the running stone must be taken off, and the furrows cut deeper in both by means of a chissel and hammer. Thus, however, by having the furrows cut down a great number of times, the thicknesses of both stones are greatly diminished; and it is observed, that in proportion to the diminution of the thickness of the upper stone, the quantity of flour also diminishes.

By means of the circular motion of the upper stone, the corn is brought out of the hopper by jerks, and recedes from the centre towards the circumference by the centrifugal force; and being entirely reduced to flour at the edges when the stones nearly touch one another, it is thrown at last out at the hole called the eye, as already mentioned. In Scotland, it is frequent to have the stones without any furrows, and only irregularly indented with small holes, by means of an iron instrument. Stones of this kind last a much shorter time than those with furrows, the latter being fit for use for 30 or 40 years, while the former seldom or never last more than seven. The under mill-stone is considerably thicker than the upper; and therefore, when both have been considerably worn by use, the lower one is frequently taken up, and the upper one put in its place, the former being converted into a running-stone.

Fig. 91 shows the construction of a common water-mill, where AA is the large water-wheel, commonly about 17 or 18 feet diameter from a, the extremity of any float-board, to b the extremity of the opposite one. This wheel is turned round by the falling of the water upon the boards from a certain height, and the greater the height, provided the water runs in an uninterrupted stream, the smaller quantity will be sufficient to turn the mill. This wheel is without the mill-house, but the wheel has an axle BB of considerable length, which passes through a circular hole in the wall, and has upon it a wheel D, of eight or nine feet diameter, having 61 cogs, which turn a trundle E of ten flaves or spokes; by which means the trundle, and consequently the mill-stone, will make six revolutions, and one-tenth for every revolution of the wheel. The odd cog, commonly called the *hunting cog*, is added, that as every one comes to the trundle it may take the staff behind that one which it took at the last revolution;

Mills.

62

Of water-mills.
Plate
CXXVIII.

Mills. tion; and thus all the parts of the cogs and rounds which work upon one another will wear equally, and to equal distances from another, in a little time; by which means a true uniform motion will be produced through the whole work. The trundle is fixed upon an iron axis called the spindle, the lower end of which turns in a brass pot fixed at F in the horizontal beam ST, called the *bridge-tree*; and the upper part of the spindle turns in a wooden bush, fixed into the lower mill-stone, which lies upon beams in the floor YY. The top part of the spindle above the bush is square, and goes into a square hole in a strong iron cross *abcd*, fig. 92, called the *rynd*; under which, and close to the bush, is a round piece of thick leather upon the spindle, which it turns round at the same time that it does the rynd. The latter enters into the grooves in the under surface of the running mill-stone G, fig. 91, and thus turns it wheel along with the trundle E, by means of the cog-wheel D. In the middle of the upper mill-stone is a large hole called the *eye*, through which the middle part of the rynd and upper part of the spindle may be seen; the ends being hid in the grooves below the stone. The end T of the bridge-tree TS, which supports the upper mill-stone G upon the spindle, is fixed into a hole in the wall; and the end S is let into the beam QR called the *brayer*; one end R of which remains fixed in a mortise, while the other end Q hangs by a strong iron rod P, which goes through the floor YY, and has a screw-nut on its top O; by the turning of which nut the end Q of the brayer is raised or depressed at pleasure, along with the bridge-tree TS and upper mill-stone. Thus the upper mill-stone may be raised as high from the under one, or let down as close to it, as the miller pleases; by which means the meal or flour is made either coarse or fine at pleasure. The upper mill-stone G is inclosed in a round box H, which leaves a vacant space of about an inch all round. On the top of this box stands a frame for holding the hopper *kl*, at which hangs the shoe l, by two lines fastened to the hinder part of it, fixed upon hooks in the hopper, and by one end of the string K to the fore part of it at i, the other end being twisted round the pin L. As the pin is turned one way, the string draws up the shoe closer to the hopper, and so lessens the aperture between them; and as the pin is turned the other way, it lets down the shoe, and widens the aperture. If it be drawn quite up to the hopper, no corn can fall out from the latter into the mill, and the quantity will be greater or less as the shoe is farther from the hopper or nearer to it. This happens by reason of the hopper being open at bottom, and the shoe at the forepart towards the end i over the middle of the eye of the mill-stone. There is also a square hole in the top of the spindle, in which is put the feeder *e*, fig. 92. Thus the shoe is jogged three times in each revolution, and the corn runs constantly down from the hopper through the shoe into the eye of the mill-stone, where it falls upon the top of the rynd, and, by the motion of that and of the leather beneath, is introduced betwixt the stones, and by the violent motion of the upper one acquires a centrifugal force; and proceeding gradually from the eye of the mill-stone towards the circumference, is thrown at last out in flour, at the hole called the eye of the mill.

VOL. X. Part II.

Some degree of nicety is requisite in feeding the mill; for if too great a quantity be poured into it, the stones are separated from each other more than they ought to be, and their motion is also impeded; while, on the other hand, if it be fed too slowly, the stone moves with too great velocity, and the attrition of the two is apt to make them strike fire. This matter is regulated by turning the pin L backwards or forwards as the miller thinks proper.

Sometimes, where plenty of water can be had, there are two trundles applied to the cog-wheel by means of a single large one turned immediately by the perpendicular cog-wheel, and carrying round with it an horizontal cogged wheel; on each side of which are placed the smaller trundles above-mentioned carrying the stones. In like manner, the water-wheel may be made to drive fanners, boulding-mills, &c. but it must always be remembered, that by complicating machinery to a great degree, it becomes more ready to give way; and the frequent reparation of which it stands in need, will, by the delay of business, be found at last more expensive than if separate machines had been used.

The wind-mill is furnished with an apparatus similar to the water-mill, but necessarily differs in the external apparatus for applying the power. This is done by means of the two arms AB and CD, fig. 93, intersecting each other at right angles in E, and passing through the axis EF, and about 32 feet in length.—On these yards are placed two sails or vane, in the shape sometimes of parallelograms, and sometimes of trapeziums, with parallel bales; the greater whereof HI is about six feet, and the length of the smaller FG is determined by radii drawn from the centre E to I and H.

As the direction of the wind is very uncertain, it becomes necessary to have some contrivance for turning the sails towards it, in order to receive its force in whatever way it may turn; and for this purpose two general methods are in use. In the one, the whole machine is sustained upon a moveable arbor or axis, perpendicular to the horizon, and which is supported by a strong stand or foot very firmly fixed in the earth; and thus by means of a lever the whole machine may be turned round as occasion requires. In the other method, only the roof, which is circular, can be turned round by means of a lever and rollers, upon which the circular roof moves. This last kind of wind-mill is always built of stone, in the form of a round turret, having a large wooden ring on the top of it, above which the roof, which must likewise be of wood, moves upon rollers, as has been already mentioned. To effect this motion the more easily, the wooden ring which lies on the top of the building is furnished with a groove, at the bottom of which are placed a number of brass truckles at certain distances, and within the groove is placed another ring, by which the whole roof is supported. The beams *ab* and *ac* are connected with the moveable ring, and a rope is fastened to the beam *ab* in *b*, which at the other extremity is fitted to a windlass or axis in peritrochio; and this rope being drawn through the iron hook G, and the windlafs turned round, the sails and roof will be turned round also, in order to catch the wind in any direction. Both these methods of construction have their advantages and disadvantages. The former is the least expensive, as the whole may be made of

5 D

wood,

Mills.

wood, and of any form that is thought proper; while the other requires a costly building of stone: and the roof being round, the building must also be so, while the other can be made of any form, but has the inconvenience of being liable to be carried off altogether by a very high wind, of which an instance occurred not long ago in Essex.

Fig. 94. shows the internal mechanism of a wind-mill. AHO is the upper room; H o Z the lower one; AB the axle-tree passing through the mill; STVW the sails covered with canvas set obliquely to the wind, and turning round in the order of the letters. CD is the cog-wheel, having about 48 cogs *aaa*, &c. which carry round the lantern EF, having eight or nine trundles *ccc*, &c. along with the axis GN. IK is the upper mill-stone, LM the lower one; QR is the bridge supporting the axis or spindle GN, which rests upon the beams *cd*, XY, wedged up at *c*, *d*, and X: ZY is the lifting tree, which stands upright; *ab* and *ef* are levers, having Z and *e* as centres of motion; *fgbi* is a cord, with a stone *i* wound about the pins *g* and *b*, and which thus serves as a balance or counterpoise. The spindle *t* N is fixed to the upper mill-stone IK by means of a piece of iron called the rynd, and fixed in the lower side of the stone, the whole weight of which rests upon a hard stone fixed in the bridge QR at N. The trundle EF and axis G may be taken away; for it rests its lower part by *t* in a square socket, and the top runs in the edge of the beam *w*. By bearing down the end of the lever *fe* we raise *b*, which raises also ZY, and this raises YX, which lifts up the bridge QR, with the axis NG, and the upper stone IK; so that by this contrivance the stones may, as in a water-mill, be set at any distance. The lower stone is fixed upon strong beams, and is broader than the upper one; the flour being conveyed through the tunnel *no* into a chest. P is the hopper into which the corn is put, and which runs along the spout *r* into the hole *s*, and so falls between the stones, where it is ground. The square axis G *t* shakes the spout *r* as it turns round, and makes the corn run out; *r* is a string going round the pin *s*, which serves to bring the spout nearer or let it go farther from the axis, and thus makes the corn to run faster or slower according to the velocity of the wind. If the wind be very strong, only part of the sails S, T, V, W, is covered, or perhaps only one half of the two opposite sails. Another cog-wheel B is placed towards the end B of the axle tree, with a trundle and mill-stones like those already described; so that when the wind is strong, the mill may do twice the business it ordinarily does. When only one pair is to grind, the trundle EF and axis G *t* are taken out from the other: *xyz* is a girt of pliable wood, fixed at the end *x*; and the other end *z* is tied to the lever *km*, moveable about *k*; and the end *m* being put down, draws the girt *xyz* close to the cog-wheel; and thus the motion of the mill may be stopped at pleasure: *pq* is a ladder for ascending to the higher part of the mill; and the corn is drawn up by means of a rope rolled about the axis AB.

63
A threshing
mill.

Besides these mills for grinding corn, one has lately been invented by a Mr Winlaw for threshing it out, and for which he has obtained a patent. It is represented fig. 95. A A A A represents the frame of the

Mills.

mill, B the cone, C a large iron wheel, D a regulating screw, E a pinion, G the top curb surrounding the nut, H the fly.

Before the corn is put into this mill, it must undergo the operations of combing the bottoms of the sheaves, and stripping the ears from the straw. The former is performed by means of an hand-comb. The use is obvious, viz. to take out all the loose ears, and straw laid irregularly, which would otherwise be lost, or impede the stripping of the ears. The comb for stripping the ears is made in the form of a cross. The teeth are of an angular form, and set at convenient distances, so as to strip the ears clean. If set too wide, they will pass through without effect; and if too near together, they will not admit the straw to go between them.

The grain is separated from the chaff and straw of the ear by the motion of the inner nut within the outward cope. The distance betwixt these is adjusted by the regulating screw D at the bottom; for if this be screwed up too far, the grain will be bruised, if too far lowered down, the grain will not be separated. The dart marked upon the fly shows the direction in which the handle is to be turned, it being pointed as the handle is to be turned.

This mill was tried in the month of June 1785, in the presence of a number of gentlemen, with great satisfaction to the spectators; and since that time has been used by a number of others, though it has not as yet come into general use. At the first trial three passed through the mill one bushel of heads per minute, with very moderate labour to the man who turned it; and by experiment it was found, that four bushels of ears yielded one bushel of clean grain. Hence it appears, that the difference betwixt the expedition of the mill and the labour of the thresher is immensely great; for allowing that a man will thresh six bushels per day at eight hours work, the mill will clear that quantity in 24 minutes, and that to much greater perfection than can be done by the flail, as it separates every grain from the ear, which cannot but be accounted a very great saving; while much corn flies off by the flail, and a great deal is lost by foul threshing, either when performed by talk or day-work. But by the use of the mill, all fraudulent practices must be prevented, the straw preserved in its original reed, and thus answer the purposes of thatching, &c. much better than when bruised under the flail; and every other purpose equally well. The ears may also be combed out with great expedition, as a lad without having practised was found to comb out a bushel of ears in 20 minutes, which is at the rate of six bushels of clean corn per day. The saving by the use of this mill is calculated at 2½d. per bushel. On a smaller scale the mill answers equally well for clover-seed, the flowers being first combed off from the stems; after which it will do as much work in three hours, as a man in the ordinary way can perform in a week; for a man cannot clean much above a bushel in that time, which is the great reason of the high price of clover-seed. The mill will likewise answer for flax, canary, or any other seeds, or for separating the husks from rice, which in the present mode cannot be done without great labour and expence.

In all mills it is necessary that a considerable power be

Mills.

be employed in order to accomplish the intended purpose.—Water is the most common power, and indeed the best, as being the most constant and equable; while wind comes at sometimes with great violence, and at others is totally gone. Mills may also be moved by the force of steam, as were the Albion-mills at London; but the expence of fuel must undoubtedly prevent this mode of constructing mills from ever becoming general. In all cases it is absolutely necessary to make the most of the power that we can, by making it act to the greatest advantage. Hence the best methods of constructing water and wind-mills have been investigated by those who were most conversant in the principles of mechanics; and so difficult has been the investigation, that the principles are not yet settled absolutely without dispute.

64
Different
kinds of
mills.

The water-mills are of three kinds: *Breast-mills, Under-shot-mills, and Over-shot-mills.* In the former, the water falls down upon the wheel at right angles, to the float-boards or buckets placed all round the wheel to receive it: if float-boards are used, it acts only by its impulse; but if buckets, it acts also by the weight of water in the buckets in the under quarter of the wheel, which is considerable. In the underhot wheel float-boards only are used, and the wheel is turned merely by the force of the current running under it, and striking upon the boards. In the overhot-wheel the water is poured over the top, and thus acts principally by its weight; as the fall upon the upper part of the wheel cannot be very considerable, lest it should dash the water out of the buckets. Hence it is evident, that an underhot-mill must require a much larger supply of water than any other; the breast-mill the next, unless the fall is very great; and an over-shot mill the least. Dr Desaguliers found, that a well-made overshot mill would perform as much work as an underhot one with one tenth part of the quantity of water required by the other.

65
Smeaton's
observations
on
mills.

In the 51st volume of the Philosophical Transactions, Mr Smeaton has considered at great length the best methods of constructing all these mills from machines and models made on purpose: but conscious of the inferiority of models to actual practice, did not venture to give his opinion without having seen them actually tried, and the truth of his doctrines established by practice.

Having described the machines and models used for making his experiments, he observes, that, with regard to power, it is most properly measured by the raising of a weight; or, in other words, if the weight raised be multiplied by the height to which it can be raised in a given time, the product is the measure of the power raising it; and, of consequence, all those powers are equal whose products made by such multiplication are equal: for if a power can raise twice the weight to the same height, or the same weight to twice the height in the same time that another can, the former power will be double the latter; but if a power can only raise half the weight to double the height,

or double the weight to half the height, in the same time that another can, the two powers are equal. This, however, must be understood only of a slow and equable motion, without acceleration or retardation; for if the velocity be either very quickly accelerated or retarded, the *vis inertia*, in our author's opinion, will produce an irregularity.

To compute the effects of water-wheels exactly, it is necessary to know in the first place what is the real velocity of the water which impinges on the wheel.

2. The quantity of water expended in a given time; and, 3. How much of the power is lost by the friction of the machinery.

1. With regard to the velocity of the water, Mr Smeaton determined by experiments with the machinery described in the volume referred to, that with a head of water 15 inches in height, the velocity of the wheel is 8.96 feet in a minute. The area of the head being 105.8 inches, this multiplied by the weight of a cubic inch of water equal to .579 of an ounce avoirdupoise, gives 61.26 ounces for the weight of as much water as is contained in the head upon one inch in depth: and by further calculations derived from the machinery made use of, he computes that 264.7 pounds of water descend in a minute through the space of 15 inches. The power of the water, therefore, to produce mechanical effects in this case will be 264.7×15 , or 3970. From the result of the experiment, however, it appeared that a vast quantity of the power was lost; the effect being only to raise 9.375 pounds to the height of 135 inches; so that the power was to the effect as 3970 to $9.375 \times 135 = 1266$, or as 10 to 3.18.

This, according to our author, must be considered as the greatest single effect of water upon an under-shot-wheel, where the water descends from an height of 15 inches; but as the force of the current is not by any means exhausted, we must consider the true proportion betwixt the power and effect to be that betwixt the quantity of water already mentioned and the sum of all the effects producible from it. This remainder of power, it is plain, must be equal to that of the velocity of the wheel itself multiplied into the weight of the water. In the present experiment, the circumference of the wheel moved with the velocity of 3.123 feet in a second, which answers to a head of 1.82 inches (A); and this height being multiplied by 264.7, the quantity of water expended in a minute gives 481 for the power of the water after it has passed the wheel; and hence the true proportion betwixt the power and the effect will be as 3849 to 1266; or as 11 to 4.

As the wheel revolved 86 times in a minute, the velocity of the water must be equal to 86 circumferences of the wheel; which, according to the dimensions of the apparatus used by Mr Smeaton, was as 86 to 30, or as 20 to 7.—The greatest load with which the wheel would move was 9 lb. 6 oz.; and by 12 lb. it was entirely stopped. Whence our author con-

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cludes,

(A) These calculations are founded upon the known maxim in hydrostatics, that the velocity of spouting water is nearly the same with that which an heavy body would acquire by falling from an height equal to that of the reservoir, and is proved by the rising of jets nearly to the height of their reservoirs.

cludes, that the impulse of the water is more than than double of what it ought to be according to theory : but this he accounts for by observing, that in his experiment the wheel was placed not in an open river, where the natural current, after it has communicated its impulse to the float, has room on all sides to escape, as the theory supposes, but in a conduit, to which the float being adapted, the water cannot otherwise escape than by moving along with the wheel. It is observable, that a wheel working in this manner, as soon as the water meets the float, receiving a sudden check, it rises up against the float like a wave against a fixed object, inasmuch that when the sheet of water is not a quarter of an inch thick before the float, yet this sheet will act upon the whole surface of a float whose height is three inches : and consequently, was the float no higher than the thickness of the sheet of water, as the theory also supposes, a great part of the force would have been lost by the water dashing over the float.

Mr Smeaton next proceeds to give tables of the velocities of wheels with different heights of water ; and from the whole deduces the following conclusions.

1. The virtual, or effective head, being the same, the effect will be nearly as the quantity of water expended.

2. The expence of water being the same, the effect will be nearly as the height of the virtual or effective head.

3. The quantity of water expended being the same, the effect is nearly as the square of the velocity.

4. The aperture being the same, the effect will be nearly as the cube of the velocity of the water. Hence, if water passes out of an aperture in the same section, but with different velocities, the expence will be proportional to the velocity ; and therefore, if the expence be not proportional to the velocity, the section of the water is not the same.

5. The *virtual head*, or that from which we are to calculate the power, bears no proportion to the head water ; but when the aperture is larger, or the velocity of the water less, they approach nearer to a coincidence : and consequently, in the large openings of mills and sluices, where great quantities of water are discharged from moderate heads, the head of water, and virtual head determined from the velocity, will nearly agree, which is also confirmed by experience.

6. The most general proportion betwixt the power and effect is that of 10 to 3 ; the extremes 10 to 3.2, and 10 to 2.8. But as it is observable, that where the power is greatest, the second term of the ratio is greatest also ; whence we may allow the proportion subsisting in great works to be as three to one.

7. The proportion of velocity between the water and wheel is in general about 5 to 2.

8. There is no certain ratio between the load that the wheel will carry at its *maximum*, and what will totally stop it ; though the proportions are contained within the limits of 20 to 19, and 20 to 15 ; but as the effect approaches nearest to the ratio of 20 to 15, or of 4 to 3 when the power is greatest either by increase of velocity or quantity of water, this seems to be the most applicable to large works : but as the load that a wheel ought to have, in order to work to the

best advantage, can be assigned by knowing the effect that it ought to produce, and the velocity it ought to have in producing it, the exact knowledge of the greatest load it will bear is of the least consequence in practice.

Mr Smeaton, after having finished his experiments on the underhot mills, reduced the number of floats, which were originally 24, to 12 ; which caused a diminution in the effect, by reason that a greater quantity of water escaped between the floats and the floor than before ; but on adapting to it a circular sweep of such a length, that one float entered into the curve before the other left it, the effect came so near that of the former, as not to give any hopes of advancing it by increasing the number of floats beyond 24 in this particular wheel.

Our author next proceeds to examine the power of water when acting by its own gravity in turning an overhot wheel : " In reasoning without experiment (says he,) one might be led to imagine, that however different the mode of application is, yet that, whenever the same quantity of water descends through the same perpendicular space, the natural effective power would be equal, supposing the machinery free from friction, equally calculated to receive the full effect of the power, and to make the most of it : for if we suppose the height of a column of water to be 30 inches, and resting upon a base or aperture of one inch square, every cubic inch of water that departs therefrom will acquire the same velocity or momentum from the uniform pressure of 30 cubic inches above it, that one cubic inch let fall from the top will acquire in falling down to the level of the aperture ; one would therefore suppose that a cubic inch of water let fall through a space of 30 inches, and there impinging upon another body, would be capable of producing an equal effect by collision, as if the same cubic inch had descended through the same space with a slower motion, and produced its effects gradually. But however conclusive this reasoning may seem, it will appear in the course of the following deductions, that the effect of the gravity of descending bodies is very different from the effect of the stroke of such as are non-elastic, though generated by an equal mechanical power."

Having made such alterations in his machinery as were necessary for overhot wheels, our author next gives a table of experiments with the apparatus so altered. In these the head was 6 fix inches, and the height of the wheel 24 inches ; so that the whole descent was 30 inches : the quantity of water expended in a minute was 96½ pounds ; which multiplied by 30 inches, gives the power = 2900 : and after making the proper calculations, the effect was computed at 1914 ; whence the ratio of the power to it comes to be nearly as 3 to 2. If, however, we compute the power from the height of the wheel only, the power will be to the effect nearly as 5 to 4.

From another set of experiments the following conclusions were deduced.

1. The effective power of the water must be reckoned upon the whole descent ; because it must be raised to that height in order to be able to produce the same effect a second time. The ratios between the powers

Mills.

powers so estimated and the effects at a *maximum*, differ nearly from 4 to 3, and from 4 to 2. Where the heads of water and quantities of it expended are the least, the proportion is nearly from 4 to 3; but where the heads and quantities are greatest, it comes nearer to that of 4 to 2; so that by a medium of the whole the ratio is nearly as 3 to 2. Hence it appears, that the effect of overhot wheels is nearly double to that of underhot ones; the consequence of which is, that non-elastic bodies, when acting by their impulse or collision, communicate only a part of their original impulse, the remainder being spent in changing their figure in consequence of the stroke. The ultimate conclusion is, that the effects as well as the powers are as the quantities of water and perpendicular heights multiplied together respectively.

2. By increasing the head, it does not appear that the effects are at all augmented in proportion; for by raising it from 3 to 11 inches, the effect was augmented by less than one-seventh of the increase of perpendicular height. Hence it follows, that the higher the wheel is in proportion to the whole descent, the greater will be the effect; because it depends less upon the impulse of the head, and more upon the gravity of the water in the buckets: and if we consider how obliquely the water issuing from the head must strike the buckets, we shall not be at a loss to account for the little advantage that arises from the impulse thereof, and shall immediately see of how little consequence this is to the effect of an overhot wheel. This, however, as well as other things, must be subject to limitation; for it is necessary that the velocity of the water should be somewhat greater than the wheel, otherwise the latter will not only be retarded by the striking of the buckets against the water, but some of the power will be lost by the dashing of the water over the buckets.

3. To determine the velocity which the circumference of the wheel ought to have in order to produce the greatest effect, Mr Smeaton observes, that the more slowly any body descends by the force of gravity when acting upon any piece of machinery, the more of that force will be spent upon it, and consequently the effect will be the greater. If a stream of water falls into the bucket of an overhot wheel, it will be there retained till the wheel discharges it by moving round; and of consequence, the slower the wheel moves, the more water it will receive; so that what is lost in velocity is gained by the greater pressure of water upon the buckets. From the experiments, however, it appears, that when the wheel made about 20 turns in a minute the effect was greatest; when it made only 18 $\frac{1}{2}$ the motion was irregular; and when loaded so as not to admit its turning 18 times, the wheel was overpowered with the load. When it made 30 turns, the power was diminished by about $\frac{1}{10}$ th, and when the number of turns was increased to 40, it was diminished by one-fourth. Hence we see, that in practice the velocity of the wheel should not be diminished farther than what will procure some solid advantage in point of power; because, *ceteris paribus*, the buckets must be larger as the motion is slower; and the wheel being more loaded with water, the stress will be proportionally increased upon every part of the work. The best velocity for practice therefore

Mills.

will be that when the wheel made 30 turns in a minute, which is little more than three feet in a second. This velocity is applicable to the highest overhot wheels as well as the lowest. Experience however determines, that high wheels may deviate further from this rule before they will lose their power, by a given aliquot part of the whole, than low ones can be permitted to do; for a wheel of 24 feet high may move at the rate of 6 feet *per* second; while our author has seen one of 33 feet high move very steadily and well with a velocity of little more than two feet. The reason of this superior velocity in the 24 feet wheel, may probably be owing to the small proportion that the head requisite to give the proper velocity to the wheel bears to the whole height.

4. The maximum load for an overhot wheel is that which reduces the circumference of the wheel to its proper velocity; which is known by dividing the effect it ought to produce in a given time by the space intended to be described by the circumference of the wheel in the same time: the quotient will be the resistance overcome at the circumference of the wheel, and is equal to the load required, including the friction and resistance of the machinery.

5. The greatest velocity that an overhot wheel is capable of, depends jointly upon the diameter or height of the wheel and the velocity of falling bodies; for it is plain that the velocity of the circumference can never be greater than to describe a semi-circumference, while a body let fall from the top describes the diameter, nor even quite so great; as the difference in point of time must always be in favour of that which falls through the diameter. Thus, supposing the diameter of the wheel to be 16 feet and an inch in diameter, an heavy body would fall through this space in one second; but such a wheel could never arrive at this velocity, or make one turn in two seconds, nor could an overhot wheel ever come near it; because, after it has acquired a certain velocity, great part of the water is prevented from entering the buckets, and part is thrown out again by the centrifugal force: and as these circumstances have a considerable dependence upon the form of the buckets, it is impossible to lay down any general rule for the velocity of this kind of wheels.

6. Though in theory we may suppose a wheel to be made capable of overcoming any resistance whatever, yet as in practice it is necessary to make the wheel and buckets of some certain and determinate size, we always find that the wheel will be stopped by such a weight as is equal to the effort of the water in all the buckets of a semi-circumference put together. This may be determined from the structure of the buckets themselves; but in practice, an overhot wheel becomes unserviceable long before this time; for when it meets with such an obstacle as diminishes its velocity to a certain degree, its motion becomes irregular; but this never happens till the velocity of the circumference is less than the two feet *per* second, when the resistance is equal.

7. From the above observations, we may easily deduce the force of water upon breast-wheels, &c. But in general, all kinds of wheels where the water cannot descend through a given space unless the wheel moves with it, are to be considered as overhot wheels; and those

those which receive the impulse or shock of the water, whether in an horizontal, oblique, or perpendicular direction, are to be considered as undershots. Hence a wheel in which the water strikes at a certain point below the surface of the head, and after that descends in the arch of a circle, pressing by its gravity upon the wheel, the effect of such a wheel will be equal to that of an undershot whose head is equal to the difference of level between the surface of the water in the reservoir and the point where it strikes the wheel, added to that of an overshoot, whose height is equal to the difference of level between the point where it strikes the wheel and the level of the tail-water.

66
Dispute
concerning
Sir Isaac
Newton's
doctrine of
motion con-
sidered.

In the 66th volume of the Transactions, our author considers some of the causes which have produced disagreements and disputes among mathematicians upon this subject. He observes, that soon after Sir Isaac Newton had given his definition, "that the quantity of motion is the measure of the same, arising from the velocity and quantity of matter conjointly," it was controverted by his cotemporary philosophers. They maintained, that the measure of the quantity of motion should be estimated by taking the quantity of matter and the square of the velocity conjointly. On this subject he remarks, that from equal impelling powers acting for equal intervals of time, equal augmentations of velocity are acquired by given bodies when they are not resisted by a medium. Thus a body descending one second by the force of gravity, passes through a space of 16 feet and an inch; but at the end of that time it has acquired a velocity of 32 feet 2 inches in a second; at the end of two seconds, it has acquired one that would carry it through 64 feet 4 inches in a second. If, therefore, in consequence of this equal increase of velocity, we define this to be a double quantity of motion generated in a given time in a certain quantity of matter, we come near to Sir Isaac's definition: but in trying experiments upon the effects of bodies, it appears, that when a body is put in motion by whatever cause, the impression it will make upon an uniformly resisting medium, or upon uniformly yielding substances, will be as the mass of matter of the moving body multiplied by the square of its velocity. The question therefore properly is, whether those terms, the *quantity of motion*, the *momenta*, or *forces* of bodies in motion, are to be esteemed equal, double, or triple, when they have been generated by an equable impulse acting for an equal, double, or triple time? or that it should be measured by the effects being equal, double, or triple, in overcoming resistances before a body in motion can be stopped? For according to the meaning we put upon these words, the momenta of equal bodies will be as the velocities or squares of the velocities of the moving bodies.

Though by a proper attention to the terms employed, however, we will find both these doctrines to be true; it is certain that some of the most celebrated writers upon mechanics have fallen into errors by neglecting to attend to the meaning of the terms they make use of. Defaguliers, for instance, after having been at pains to show that the dispute, which in his time had subsisted for 50 years, was a dispute merely about words, tells us, that both opinions may be easily reconciled in the following case, viz. that the

wheel of an undershot water-mill is capable of doing quadruple work when the velocity of the water is doubled, instead of double work only: "For (says he) the adjuantage being the same, we find, that as the water's velocity is double, there are twice the number of particles that issue out, and therefore the ladle-board is struck by twice the matter; which matter moving with twice the velocity that it had in the first case, the whole effect must be quadruple, though the instantaneous stroke of each particle is increased only in a simple proportion of the velocity." In another place, the same author tells us, that though "the knowledge of the foregoing particulars is absolutely necessary for setting an undershot wheel to work, yet the advantage to be reaped from it would be still guess-work; and we should be at a loss to find out the utmost that it could perform, had it not been for an ingenious proposition of that excellent mechanic M. Parent of the Royal Academy of Sciences, who has showed, that an undershot wheel can do the most work when its velocity is equal to the third part of that of the water; because then two-thirds of the water is employed in driving the wheel, with a force proportionable to the square of the velocity. By multiplying the surface of the adjuantage or opening by the height of the water, we shall have the column of water that moves the wheel. The wheel thus moved will sustain on the opposite side only four-ninths of that weight which will keep it in equilibrio; but what it can move with the velocity it has, is only one-third of the equilibrium." This conclusion is likewise adopted by Mr Maclaurin.

Undershot wheels had been greatly preferred by M. Belidor to those of any other construction. He had even concluded, that water applied in this way will do more than six times the work of an overshoot wheel; while Dr Defaguliers, in overthrowing Belidor's proposition, determined that an overshoot wheel would do 10 times the work of an undershot wheel with an equal quantity of water. Between these two celebrated authors, therefore, there is a difference of no less than 60 to 1.

In consequence of such monstrous disagreement, Mr Smeaton began the experiments of which we have already given an account. From them, besides the positions already deduced, it appears, that where the velocity of water is double, the adjuantage or aperture of the sluice remaining the same, the effect is eight times; that is, not as the square, but as the cube of the velocity. In the other conclusion of Defaguliers and Maclaurin, the error was no less; for from thence it would follow, that by means of the wheel only $\frac{1}{27}$ ths of the water expended would be raised back again to the height of the reservoir from which it descended, exclusive of the friction, which would still diminish the quantity; but from Mr Smeaton's experiments it appears, that in some cases upwards of one-fourth had been raised. In large works the effects had been still greater, approaching in an undershot wheel to one half, and in an overshoot one to the whole; which would be the limit, if it were possible, to remove the friction and resistance of the air. The velocity of the wheel also, which, according to the conclusions of M. Parent and Dr Defaguliers, amounted to no more than one-third of the velocity of the water,

67
Enormous
mistakes of
Belidor
and others.

ter, varies, according to Mr Smeaton, between one-third and one-half. But in all great works the maximum lieth much nearer to one-half than a third; the former appearing to be the true maximum, if all friction, resistance of the air, and scattering of water, could be avoided.

To make these matters plain to mechanics, and to prevent them from running into practical errors in consequence of a fallacious theory, Mr Smeaton, in the year 1759, instituted another set of experiments; the immediate object of which was, to determine what proportion or quantity of mechanical power is expended in giving the same body different degrees of velocity. Having constructed a proper apparatus for the purpose, and with it made a number of experiments, he concludes, "that time, properly speaking, has nothing to do with the production of mechanical effects otherwise than as by equally flowing it becomes a common measure; so that whatever mechanical effect is found to be produced in a given time, the uniform continuance of the action of the same mechanical power will, in a double time, produce twice that effect. A mechanical power, therefore, properly speaking, is measured by the whole of its mechanical effects produced, whether that effect be produced in a greater or lesser time: thus, having treasured up 1000 tons of water, which I can let out upon the overshot wheel of a mill, and descending through a perpendicular of 20 feet; this power, applied in a proper manner, will grind a certain quantity of corn in an hour: but supposing the mill to be capable of receiving a greater impulse with as great advantage as a lesser; then, if the corn be let out twice as fast, the same quantity of water will be ground in half an hour, the whole of the water being likewise expended in that time. What time has therefore to do in the case is this: let the rate of doing the business or producing the effect be what it will; if this rate is uniform, when I have found by experiment what is done in a given time, then, proceeding at the same rate, twice the effect will be produced in twice the time, on supposition that I have a supply of mechanic power to go on with. Thus, 1000 tons of water descending through 20 feet perpendicular, being, as has been shown, a given mechanic power, let it be expended at what rate it will; if, when this is expended, we are to wait another hour till an equal quantity can be procured, then we can only expend 12 such quantities in 24 hours. But if, while the thousand tons of water are expending in one hour, the same quantity is renewed, we can then expend 24 such in the 24 hours, or go on without intermission. The product or effect will then be in pro-

portion to time; which is the common measure; but the quantity of mechanic power arising from the flow of the two rivers, compared by taking an equal portion of time, is double in the one to the other; though each has a mill that, when going, will grind an equal quantity of corn in an hour."

Mr Ferguson, in his directions to mill-wrights, has adopted the maxim which Mr Smeaton condemns as erroneous, viz. that when the velocity of the wheel is but one-third of that of the water, it then acts to the greatest advantage. He adds, that the millstone ought to make about 60 turns in a minute; for when it makes only 40 or 50 turns it grinds too slowly; and when more than 70, it heats the meal too much, and cuts the bran so small, that a part of it mixes with the meal and cannot be separated from it by any means. The utmost perfection of mill-work, therefore, according to this author, lies in making the train so that the millstone shall make about 60 turns in a minute, when the wheel moves with one-third of the velocity of the water. To accomplish this he lays down the following rules. 1. Measure the perpendicular height of the fall of water above the middle of the aperture, where it is let out to act by impulse against the float-boards on the lower side of the undershot wheel. 2. Multiply this constant number 64.2882 by the height of the fall in feet, and extract the square-root of the product, which will give the number of feet that the water moves in a second. 3. The velocity of the floats of the wheel is equal to one-third of the velocity of the water just now found. 4. Divide the circumference of the wheel by the velocity of its floats, and the quotient will be the number of seconds in one turn of the great water-wheel, on whose axis the cog-wheel that turns the trundle is fixed. 5. Divide 60 by the number of seconds in a turn of the water-wheel, and the quotient will be the number of turns it makes in a minute. 6. By this number of turns divide 60, the number of times that a millstone ought to have in a minute; the quotient is the number of turns that the millstone ought to make for every one of the large wheel. 7. Then as the number of turns required of the millstone in a minute is to the number of turns of the cog-wheel in a minute; so must the number of cogs in the wheel be to the number of flaves in the trundle on the axis of the millstone, in the nearest whole number that can be found.

On these principles Mr Ferguson has constructed the following table, for the sake of such as have occasion to construct mills, and are not willing to take the trouble of particular calculations.

The Mill-wright's TABLE.

Height of the fall of water.	Velocity of the fall of water per second.	Velocity of the wheel per second.	Revolutions of the wheel per minute.	Revolution of the millstone for one of the wheel	Cogs in the wheel, and flaves in the trundle.	Revolutions of the millstone per minute by these flaves and cogs.
Fect.	100 parts of a foot. Fect.	100 parts of a foot. Fect.	100 parts of a rev. Revolutions.	100 parts of a rev. Revolutions.	Cogs. Slaves.	100 parts of a rev. Revolutions.
1	8 02	2 67	2 83	42 40	254 6	119 84
2	11 34	3 78	4 00	30 00	210 7	120 00
3	13 89	4 63	4 91	24 44	196 8	120 28
4	16 04	5 35	5 67	21 16	190 9	119 74
5	17 93	5 98	6 34	18 92	170 9	119 68
6	19 64	6 55	6 94	17 28	156 9	120 20
7	21 21	7 07	7 50	16 00	144 9	120 00
8	22 68	7 56	8 02	14 96	134 9	119 34
9	24 05	8 02	8 51	14 10	140 10	119 14
10	25 35	8 45	8 97	13 38	134 10	120 18
11	26 59	8 86	9 40	12 76	128 10	120 30
12	27 77	9 26	9 82	12 22	122 10	119 80
13	28 91	9 64	10 22	11 74	118 10	120 36
14	30 00	10 00	10 60	11 32	112 10	118 72
15	31 05	10 35	10 99	10 92	110 10	120 96
16	32 07	10 09	11 34	10 58	106 10	120 20
17	33 06	11 02	11 70	10 26	102 10	119 34
18	34 02	11 34	12 02	9 98	100 10	120 20
19	34 95	11 65	12 37	9 70	98 10	121 22
20	35 86	11 95	12 68	9 46	94 10	119 18
1	2	3	4	5	6	7

68
Imison's
practical
rules for
the con-
struction
of mills.

For the practical construction of water-mills, Mr Imison hath laid down the following rules.

1. To find the velocity or force of any moderate stream of water; let it be obstructed by a dam in such a manner as to force the whole stream into a spout by which it may be conveyed into a large vessel or reservoir. Measure then the quantity of water which falls into the reservoir in one second or minute; and multiplying by the number of seconds or minutes in an hour, we have the whole force of the stream of water per hour. In streams which are too large to be measured in this way, the velocity is determined (though we must own in a vague manner) by that of flax or other light body floating down it; and calculations may be made accordingly.

Mr Imison differs very materially from Mr Ferguson in the number of revolutions which a mill-stone ought to make in a minute; the latter, as has been already mentioned, being of opinion, that 60 revolutions of a mill-stone in a minute are sufficient, while Mr Imison requires 120; though he agrees with him that the velocity of the wheel should be only one-third of that of the water. The mill-stone, according to Mr

N^o 200.

Ferguson, ought to be five feet in diameter; but Mr Imison makes it only four feet and an half.

To construct a mill by this table, find the height of the fall of water in the first column, and against that height in the sixth column you have the number of cogs in the wheel and flaves in the trundle for causing the millstone 4 feet 6 inches diameter to make about 120 revolutions in a minute, as near as possible, when the wheel goes with one-third part of the velocity of the water. And it appears by the 7th column, that the number of cogs in the wheel and flaves in the trundle are so near the truth for the required purpose, that the least number of revolutions of the mill-stone in a minute is 118, and the greatest number never exceeds 121; which, according to our author, is the velocity of the best mills he had seen.

With regard to the mere mechanical part, our author observes, that an overshot wheel acts with greater power than a breast or under-shot wheel; so that where there is a considerable descent, and only a small quantity of water, the overshot wheel ought always to be made use of. Where the water runs only upon a little declivity, it can act but slowly upon the under part of the

Mills.

Mills.

the wheel; in which case, the motion of the wheel will be very slow: the float-boards therefore ought to be very long, though not high, that a large body of water may act upon them; so that what is wanting in velocity may be made up in power: in which case, the cog wheel may have a greater number of cogs in proportion to the staves of the trundle, in order to give the mill-stone a sufficient degree of velocity.

For the construction of the different parts of mills, Mr Imison gives the following general directions :

The method for setting out a four-wheel and wallower.

—Draw the pitch lines $A_1, B_1, A_2, 2B$; then divide them into the number of teeth or cogs required, as *abc*.

Divide one of those distances, as bc , into seven equal parts, as 1, 2, 3, 4, 5, 6, 7: three parts allow for the thickness of the cog, as 1, 2, 3, in the cog a , and four for the thickness of the flave, of the wallower (or reason for allowing three parts for the cog and four for the flave, is, the wallower is in general of less diameter than the wheel, therefore subject to more wear in proportion of the number of cogs to the number of flaves; but if there is the same number of flaves as of cogs, they may be of equal thickness), as 1, 2, 3, 4, in the flave m , fig. 97. the height of the cog is equal to four parts; then divide its height into five equal parts, as 1, 2, 3, 4, 5, in the cog C ; allow three for the bottom to the pitch line of the cog; the other two parts for epicycloid, so as to fit and bear on the flave equally. The mill-wrights in general put the point of a pair of compasses in the dot 3, of the cog a , and strike the line de ; then remove the point of the compasses to the point d , and strike the curve line $3f$, which they account near enough the figure of the epicycloid.

The method for a face-wheel is thus: Divide the pitch line AB into the number of cog intended, as abc ; divide the distance bc into seven equal parts; three of those parts allow for the thickness of the cog, as 1, 2, 3, in the cog a , four for the height and four for the width, as de , and four for the thickness of the flange m ; draw a line through the centre of the cog, as the line AI at S: and on the point g describe the line de ; remove the compasses to the point A , and draw the line fg , which forms the shape of the cog; then shape the cog on the flides to a cycloid, as $defg$. But this method of setting out the shape of a cog is variable, according to the cycloid in different diameters of wheels.

In common spur-nuts, divide the pitch line A into twice as many equal parts as you intend teeth, as a, b, c, d, e , fig. 98.; with a pair of compasses opened to half the distance of any of those divisions, from the points $a1, c3, e5$, draw the femicircles a_2, c_2 and e_2 which will form the ends of the teeth. From the points $2, 4$, and 6 , draw the femicircles ghi , which will form the hollow curves for the spaces; but if the ends of the teeth were epicycloids, instead of femicircles, they would act much better.

The principle of bevel gear,—consists in two cones, rolling on the surface of each other, as the cone A and B revolving on their centres ab , ac ; if their bases are equal, they will perform their revolutions in one and the same time, or any other two points equally distant from the centre a , as d_1 , d_2 , d_3 , &c. will revolve in

the same times f_1, f_2, f_3 , &c. In the like manner, if the cones $afde$ be twice the diameters at the base de , as the cones $afce$ are; then if they turn about their centres, when the cone $afcd$ has made one revolution, the cone $afde$ will have made but half a revolution; or when $afcd$ has made two revolutions, $afde$ will have made but one, and every part equally distant from the centre a , as f_1, f_2, f_3 , &c. will have made two revolutions to r_1, r_2, r_3 , &c. and if the cones were fluted, or had teeth cut in them, diverging from the centre a to the bases dc, ef , they would then become bevel gear. The teeth at the point of the cone being small and of little use, may be cut off at E and F figs. 102, 103, as seen by fig. 104, where the upright shaft ab , with the bevel wheel cd , turns the bevel wheel ef with its shaft fg , and the teeth work freely into each other, as ab, fg , 105. The teeth may be made of any dimension, according to the strength required; and this method will enable them to overcome a much greater resistance, and work smoother than a face wheel and wallower of the common form can possibly do; besides, it is of great use to convey a motion in any direction, or to any part of a building, with the least trouble and friction.

The method of conveying motion in any direction, and proportioning or shaping the wheels thereto, is as follows: let the line *ab* represent a shaft coming from Fig. 106. a wheel; draw the line *ed* to intersect the line *ab*, in the direction that the motion to be conveyed is intended, which will now represent a shaft to the intended motion.

Again, suppose the shaft *ed* is to revolve three times, whilst the shaft *ab* revolves once, draw the parallel line *ii*, at any distance not too great, suppose one foot by a scale; then draw the parallel line *kk* at three feet distance, after which draw the dotted line *wX*, through the intersection of the shafts *ab* and *ed*, and likewise through the intersection of the parallel lines *ii* and *kk*, in the points *X* and *y*; which will be the pitch line of the two bevel wheels, or the line where the teeth of the two wheels act on each other, as may be seen fig. 107. where the motion may be conveyed in any direction.

The universal joint, as represented fig. 108. may be applied to communicate motion instead of bevel gear, where the speed is to be continued the same, and where the angle does not exceed 30 or 40 degrees, and the equality of motion is not regarded; for as it recedes from a right line, its motion becomes more irregular. This joint may be constructed by a cross, as represented in the figure; or with four pins fastened at right angles upon the circumference of a hoop or solid ball. It is of great use in cotton-mills, where the tumbling shafts are continued to a great distance from the moving power. But by applying this joint, the shafts may be cut into convenient lengths, by which it will be enabled to overcome greater resistance.

To describe the cycloid and epicycloid, of use in shaping the teeth of wheels, &c.—If a point or pencil *a* on the circumference of the circle *B* proceeds along the plane *aC* in a right line, and at the same time revolves round its centre, it will describe a cycloid.

And if the generating circle D moves along the circumference of another circle E, and at the same time turns round its centre, the point of contact will describe an epicycloid.

Plates
CCLXXXIX,
CCXC.
fig. 100,
101.

Plate
CCXC.

Fig. 96.

Fig. 126.

Fig. 109a

Fig. 110

Mills.

Mills.

In the construction of wind-mills, Mr Smeaton has been at no less pains to explain the principles than in those which go by water. For this purpose he constructed a machine, of which a particular description is given in the 51st volume of the Philosophical Transactions. The general principle of this was, that by means of a determinate weight it carried round an axis with an horizontal arm, upon which were four small moveable sails. Thus the sails met with a constant and equable blast of air; and as they moved round, a string with a weight affixed to it was wound about their axis, and thus showed what kind of size or construction of sails answered the purpose best.

With this machine a great number of experiments were made; the results of which were as follow.

1. The sails set at the angle with the axis, proposed as the best by M. Parent and other geometricians, *viz.* 55° , was found to be the worst proportion of any that was tried.

2. When the angle of the sails with the axis was increased from 72° to 75° , the power was augmented in the proportion of 31 to 45; and this is the angle most commonly in use when the sails are planes.

3. Were nothing more requisite than to cause the sails acquire a certain degree of velocity by the wind, the position recommended by M. Parent would be the best. But if the sails are intended with given dimensions, to produce the greatest effects possible in a given time, we must, if planes are made use of, confine our angle within the limits of 72 and 75 degrees.

4. The variation of a degree or two, when the angle is near the best, is but of little consequence.

5. When the wind falls upon concave sails, it is an advantage to the power of the whole, though each part separately taken should not be disposed of to the best advantage.

6. From several experiments on a large scale, Mr Smeaton has found the following angles to answer as well as any. The radius is supposed to be divided into six parts; and $\frac{1}{6}$ th, reckoning from the centre, is called 1, the extremity being denoted 6.

No	Angle with that axis.	Angle with the plane of motion.
1	72°	18°
2	71	19
3	72	18 middle
4	74	16
5	$77\frac{1}{2}$	$12\frac{1}{2}$
6	83	7 extremity.

7. Having thus obtained the best method of *weathering* the sails, *i.e.* the most advantageous manner in which they can be placed, our author's next care was to try what advantage could be derived from an increase of surface upon the same radius. The result was, that a broader sail requires a large angle; and when the sail is broader at the extremity than near the centre, the figure is more advantageous than that of a parallelogram. The figure and proportion of enlarged sails, which our author determines to be most advantageous on a large scale, is that where the extreme bar is one-third of the radius or whip (as the workmen call it), and is divided by the whip in the proportion of 3 to 5. The triangular or loading sail is covered with board from the point downward of its

height, the rest as usual with cloth. The angles above mentioned are likewise the most proper for enlarged sails; it being found in practice, that the sails should rather be too little than too much exposed to the direct action of the wind.

Some have imagined, that the more sail the greater would be the power of the windmill, and have therefore proposed to fill up the whole area; and by making each sail a sector of an ellipsis, according to M. Parent's method, to intercept the whole cylinder of wind, in order to produce the greatest effect possible. From our author's experiments, however, it appeared, that when the surface of all the sails exceeded seven-eighths of the area, the effect was rather diminished than augmented. Hence he concludes, that when the whole cylinder of wind is intercepted, it cannot then produce the greatest effect for want of proper interstices to escape.

"It is certainly desirable (says Mr Smeaton), that the sails of windmills should be as short as possible; but it is equally desirable, that the quantity of cloth should be the least that may be, to avoid damage by sudden squalls of wind. The best structure, therefore, for large mills, is that where the quantity of cloth is the greatest in a given circle that can be: on this condition, that the effect holds out in proportion to the quantity of cloth; for otherwise the effect can be augmented in a given degree by a lesser increase of cloth upon a larger radius, than would be required if the cloth was increased upon the same radius.

8. The ratios between the velocities of windmill sails unloaded, and when loaded to their maximum, turned out very different in different experiments, but the most common proportion was as 3 to 2. In general it happened, that where the power was greatest, whether by an enlargement of the surface of the sails, or an increased velocity of the wind, the second term of the ratio was diminished.

9. The ratios between the least load that would stop the sails and the maximum with which they would turn, were confined betwixt that of 10 to 8 and 10 to 9; being at a medium about 10 to 8.3, and 10 to 9, or about 6 to 5; though on the whole it appeared, that where the angle of the sails or quantity of cloth was greatest, the second term of the ratio was less.

10. The velocity of windmill sails, whether unloaded or loaded, so as to produce a maximum, is nearly as the velocity of the wind, their shape and position being the same. On this subject Mr Ferguson remarks, that it is almost incredible to think with what velocity the tips of the sails move when acted upon by a moderate wind. He has several times counted the number of revolutions made by the sails in 10 or 15 minutes; and from the length of the arms from tip to tip, has computed, that if an hoop of the same size was to run upon plain ground with an equal velocity, it would go upwards of 30 miles in an hour.

11. The load at the maximum is nearly, but somewhat less, than as the square of the velocity of the wind; the shape and position of the sails being the same.

12. The effects of the same sails at a maximum are nearly, but somewhat less, than as the cubes of the velocity of the wind.

13. The load of the same sails at a maximum is nearly

Mills.

Mills.

nearly as the squares, and the effect as the cubes of their number of turns in a given time.

14. When sails are loaded so as to produce a maximum at a given velocity, and the velocity of the wind increases, the load continuing the same; then the increase of effect, when the increase of the velocity of the wind is small, will be nearly as the squares of these velocities; but when the velocity of the wind is double, the effects will be nearly as 10 to 27 $\frac{1}{2}$; and when the velocities compared are more than double of that where the given load produces a maximum, the effects increase nearly in a simple ratio of the velocity of the wind. Hence our author concludes, that windmills, such as the different species for draining water, &c. lose much of their effect by acting against one invariable opposition.

15. In sails of a similar figure and position, the number of turns in a given time will be reciprocally as the radius or length of the sail.

16. The load at a maximum that fails of a similar figure and position will overcome, at a given distance from the centre of motion, will be as the cube of the radius.

17. The effects of sails of similar position and figure are as the square of the radius. Hence augmenting the length of the sail without augmenting the quantity of cloth, does not increase the power; because what is gained by the length of the lever is lost by the slowness of the motion. Hence also if the sails are increased in length, the breadth remaining the same, the effect will be as the radius.

18. The velocity of the extremities of the Dutch sails, as well as of the enlarged sails, either unloaded or even when loaded to a maximum, is considerably greater than that of the wind itself. This appears plainly from the observations of Mr Ferguson already related concerning the velocity of sails, and is more fully treated of under the article WIND.

19. From many observations of the comparative effects of sails of various kinds, Mr Smeaton concludes, that the enlarged sails are superior to those of the Dutch construction.

Having thus discussed the subject of the common windmills with oblique vanes, our author next proceeds to the consideration of those called *horizontal* windmills, in which it is attempted to make the wind impinge directly upon the wheel, as in the case of water-mills. To set the probable advantage of this scheme in its proper point of view, Mr Smeaton proceeds in the following manner: "Let AB, fig. 111. be the section of a plane, in which let the wind blow in the direction CD, with such a velocity as to describe a given space BE, in a given time, suppose one second; and let AB be moved parallel to itself in the direction CD. Now, if the plane AB moves with the same velocity as the wind; that is, if the point B moves through the space BE in the same time that a particle of air would move through it, it is plain, that in this case there can be no pressure or impulse of the wind upon the plane; but if the plane moves slower than the wind, so that the point B may move to F, while a particle of air setting out from B would reach E, then BF will express the velocity of the plane; and the relative velocity of the wind and plane would be expressed by the line FE. Let the ratio of FE to BE be

given, suppose 2 to 3; let the line AB represent the impulse of the wind upon the plane AB when acting with its whole velocity BE; but when acting with its relative velocity FE, let its impulse be denoted by some aliquot part of AB, as for instance $\frac{2}{3}$; then will $\frac{2}{3}$ ths of the parallelogram AF represent the mechanical power of the plane, that is, $\frac{2}{3}$ ths AB \times $\frac{2}{3}$ BE.

"2. Let IN be the section of a plane inclined in such a manner, that the base IK of the right angled triangle IKN may be equal to AB; and the perpendicular NK=BE: let the plane IN be struck by the wind in the direction LM, perpendicular to IK; then, according to the known rules of oblique forces, the impulse of the wind upon the plane IN, tending to move it according to the direction LM or NK, will be denoted by the base IK; and that part of the impulse tending to move it, according to the direction IK, will be expressed by the perpendicular NK. Let the plane IN be moveable in the direction of IK only; that is, the point I in the direction of IK, and the point N in the direction NQ parallel thereto. Now it is evident, that if the point I moves through the line IK, while a particle of air, setting forwards at the same time from the point N, moves through the line NK, they will both arrive at the point K at the same time; and consequently there can be no pressure or impulse of the particle of air upon the plane IN. Now let IO be to IK as BF to BE; and let the plane IN move at such a rate, that the point I may arrive at O, and acquire the position OQ, in the same time that a particle of air would move through the space NK; as OQ is parallel to IN, by the properties of similar triangles, it will cut NK in the point P in such a manner, that NP will be equal to BF, and PK to FE. Hence it appears, that the plane IN, by acquiring the position OQ, withdraws itself from the action of the wind, by the same space NP that the plane AB does by acquiring the position FG; and consequently, from the equality of PK to FE, the relative impulse of the wind PK upon the plane OQ will be equal to the relative impulse of the wind upon the plane FG: and since the impulse of the wind upon AB, with the relative velocity FE, in the direction BE, is represented by $\frac{2}{3}$ AB; the relative impulse of the wind upon the plane IN in the direction NK will in like manner be represented by $\frac{2}{3}$ IK; and the impulse of the wind upon the plane IN, with the relative velocity PK, in the direction IK will be represented by $\frac{2}{3}$ NK: and consequently the mechanical power of the plane IN in the direction IK will be represented by $\frac{2}{3}$ of the parallelogram IQ; that is, $\frac{2}{3}$ IK \times $\frac{2}{3}$ NK: that is, from the equality of IK to AB, and NK to BE, we shall have $\frac{2}{3}$ IQ= $\frac{2}{3}$ AB \times $\frac{2}{3}$ BE= $\frac{2}{3}$ AB \times $\frac{2}{3}$ BE= $\frac{2}{3}$ the area of the parallelogram AF.

"Hence we deduce this general proposition; that all planes, however situated, that intercept the same section of the wind, and having the same relative velocity in regard to the wind, when reduced into the same direction, have equal powers to produce the same mechanical effects. For what is lost by the obliquity of the impulse, is gained by the velocity of the motion.

"Hence it appears, that an oblique sail is under no disadvantage in respect of power, compared with a direct one; except what arises from a diminution of its

breadth, in regard to the section of the wind; the breadth IN being by obliquity reduced to IK.

"The disadvantage of horizontal windmills therefore does not consist in this, that each sail, when directly exposed to the wind, is capable of a less power than an oblique one of the same dimensions; but that in an horizontal windmill little more than one sail can be acting at once: whereas, in the common windmill, all the four act together; and therefore, supposing each vane of an horizontal windmill to be of the same size with that of a vertical one, it is manifest that the power of a vertical mill will be four times as great as that of an horizontal one, let the number of vanes be what we will. This disadvantage arises from the nature of the thing; but if we consider the further disadvantage that arises from the difficulty of getting the sails back again against the winds, &c. we need not wonder if this kind of mill is in reality found to have not above one-eighth or one-tenth of the power of the common sort; as has appeared in some attempts of this kind."

Notwithstanding what is here advanced, it seems that the ideas of Mr Smeaton have not been very generally received, as premiums are still held forth for the best methods of constructing horizontal wind-mills. Indeed, considering the clearness and perspicuity of the above reasoning, it seems surprising that public encouragement should continue to be given to attempts which must certainly prove abortive. The principal inconvenience in wind-mills is their excessive irregularity and difficulty of being managed when the wind is high, owing to the great extent of the sails and bulk of the machinery. But were it possible to make a number of small wind-mills exert their power upon one object, these would be much more easily managed than one large one. Perhaps if a number of these were to be employed in pumping up water to a certain height from a lake or reservoir, so as to produce a constant stream of water to turn a common mill, it might be more advantageous than to employ them directly. Wind-mills are commonly erected upon eminences for the sake of receiving the wind to more advantage; and there are few eminences which do not afford a small supply of water at no great distance from their summit. This supply being collected in a reservoir, might be drawn up to the top by pumps worked by wind-mills; where being collected in another reservoir, it might be let down to the former, turning a water-mill in its way, and being again drawn up by the pumps as before.

Some projectors, considering the great power of oblique vanes in wind-mills, have attempted to improve water-mills by giving them oblique vanes, but with as little success. The power of the same section of a stream of water is not greater when acting upon an oblique vane than on a direct one; and any advantage which can be made of intercepting a greater section of water, which sometimes may be done in the case of an open river, must be counterbalanced by the superior resistance that such vanes would meet with by moving at right angles to the current; whereas the common floats always move with the water nearly in the same direction.

Mr Smeaton concludes his dissertation upon this subject, with giving a reason why one angle should be

preferable to another in setting the sails of a wind-mill. "It is to be observed (says he), that if the breadth of the sail IN is given, the greater the angle KIN, the less will be the base IK; that is, the section of the wind intercepted will be less. On the other hand, the more acute the angle KIN, the less will be the perpendicular KN; that is, the impulse of the wind in the direction IK being less, and the velocity of the sail greater, the resistance of the medium will be greater also. Hence, therefore, as there is a diminution of the section of the wind intercepted on one hand, and an increase of resistance on the other, there is some angle where the disadvantage arising from these causes upon the whole is the least of all; but as the disadvantage arising from resistance is more of a physical than geometrical consideration, the true angle will best be assigned by experiment."

Motion of
Bodies.

SECT. VI. Of the Motion of Bodies in Straight Lines and Curves; the Acceleration, Accumulation, and Retardation, of Motion in various Circumstances.

To understand this subject, it is necessary to keep in mind what has been said concerning the *momentum* or quantity of motion in any moving body, viz. that it is compounded of the velocity multiplied into the quantity of matter. Thus, suppose there are two bodies, one containing twice the quantity of matter contained in the other, but moving with thrice its velocity, the quantities of matter will be expressed by any numbers in the proportion of 2 to 1, and their velocities by any others in the proportion of 3 to 1. Multiplying therefore the quantity of matter in the first (2) by its velocity (3), the product is 6; and multiplying the quantity of matter (1) by its velocity (1), the product is only 1; whence it appears that the momenta or absolute forces of these bodies are to one another as 6 to 1.

As some bodies are elastic and others non-elastic, the effect of motion communicated from one to another becomes very different, according to this circumstance. The motion is likewise very different, according to the manner in which one body acts upon another, and according to which it will be driven forward in a rectilinear direction, or describe curves of various kinds, revolving on its axis, &c. These different kinds of motion have been considered by different authors, but by none more particularly than Mr G. Atwood, who has published a large octavo volume upon the rectilinear motion and rotation of bodies. The fundamental laws of motion assumed by this author as axioms are three.

1. Every body perseveres in its state of rest or uniform motion in a right line, until a change is effected by the agency of some external force.

2. Any change effected in the quiescence or motion of a body is in the direction of the force impressed, and is proportional to it in quantity.

3. Action and reaction are equal, and in contrary directions.

From these three simple axioms, the truth of which must, from what has been already said, be abundantly evident, our author proceeds to demonstrate the most difficult problems concerning the impulse and motion

of

Motion of
Bodies.

of bodies in every possible direction, beginning from the most simple and easy deductions. For the more easy comprehending this subject, however, we shall premise what our author has said in his second section concerning the properties of *ratios* or proportions.

1. Two mathematical quantities of the same kind, as two lines, two surfaces, two angles, &c. constitute a ratio. Thus, suppose one line two feet in length and another four; these are to one another in the ratio of 4 to 2, or of 2 to 1; but a line cannot be said to bear any ratio to a surface, because they are not quantities of the same kind, and therefore cannot be compared.

2. We may compare the ratio of two quantities of one kind with the ratio of two quantities of a different kind. Thus, when two bodies move uniformly, for an equal time, but with different velocities, the ratio of the spaces passed over may be compared with that of the velocities, though space and velocity are accounted different quantities.

3. If any quantity be divided by another of the same kind, the quotient becomes absolute number. Thus, if we divide a velocity of four feet in a second by one of two feet in a second, the quotient will be 2; and in all cases the quotient will be to 1 as the greater quantity is to the lesser.

4. The ratio of any mathematical quantities may be expressed by two numbers, if both terms of the ratio be divided by the consequent or by the antecedent. Thus, let the antecedent be 8 and the consequent 4; let both be divided by 4, and the ratio will then be 2 to 1; or let both be divided by 8, and it will be 1 to 0.5, which is the same.

5. Any ratio may be represented by a fraction, the numerator of which is the antecedent, and the denominator the consequent. Thus the ratio of 8 to 4 is represented by the fraction $\frac{8}{4}$; and hence we may add and subtract ratios by the addition and multiplication of fractions. Thus, supposing two bodies to move uniformly, one at the rate of 8 feet in a second and the other 4; supposing them also to move the former for four, and the latter for two seconds, the spaces passed over will be 32 and 8, their ratio $\frac{32}{8}$, or at length $32:8::4\times8:2\times4$; or $\frac{1}{2}=\frac{2}{4}\times\frac{1}{2}$. Here it is to be observed, that when the mark of equality is interposed betwixt heterogeneous quantities, the only equality meant is that which subsists between the ratios there expressed; and when the mark of multiplication is interposed between heterogeneous quantities, it means the addition of two ratios, the antecedents of which are the terms expressed, and the consequents are unity.

6. If there are three ratios, consisting of variable terms, and the relation of the quantities to each other be such, that when the third ratio becomes unity the other two become equal; or when the second becomes unity, the first and third are equal; then in all cases, whatever be the magnitudes, we have the first ratio $=$ the 2d \times 3d. Thus let the three ratios be $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{4}$, diminishing the numbers by 1, we have $\frac{1}{3}$, $\frac{2}{4}$, and $\frac{3}{5}$; it is evident that $\frac{1}{3}=\frac{2}{4}\times\frac{3}{5}$; the same will be the case if we place them in a different order, as $\frac{1}{4}$, $\frac{2}{3}$, and $\frac{3}{5}$; for then, diminishing as before, we have $\frac{1}{5}$, $\frac{2}{4}$, and $\frac{3}{5}$, in which case $\frac{1}{5}=\frac{2}{4}\times\frac{3}{5}$.

7. In comparing the ratios which obtain between

 Motion of
Bodies.

mathematical quantities of any sort, the standard to which each of those quantities is referred may be taken $=$ 1. Thus, supposing we compare the weight, magnitude, and density, of any substance with water, we may take a cubic inch of that element for a standard, and call the weight, magnitude, and density of it $=$ 1; by which means we may readily compare the weight, magnitude, or density, of any quantity, however large, of another substance with water.

We now proceed to that part of the work which treats directly of the motion of bodies acted upon by any external impulse.

8. Any force acting continually upon a body in the same direction, will produce a continual acceleration or retardation of the motion. Thus, if a body descends by the force of gravity, its motion is continually accelerated; or if it be thrown up against the force of gravity, the motion will be continually retarded until it be totally destroyed.

9. If, while a body moves, equal quantities of motion be communicated to it, or taken from it in equal spaces of time, the force is said to be constant, and equally accelerated or retarded.

10. When unequal velocities are generated or destroyed in equal spaces of time, the force is said to be variable.

11. When a body is acted upon by a constant force, we must consider the space through which it moves, the time it takes to move through it, the velocity it acquires, and the force which produces it; any two of which being given, we may from them find the other two. Here we must observe, that the force mentioned relates only to the communication of the velocity, without any regard to the quantities of matter moved. As it is proportioned to the velocity generated in a given time, it is thence called the *accelerating* force. That which relates to the quantity of matter moved, as well as the velocity communicated, is called the *moving* force; being proportional to the quantity of motion produced in a given time.

12. The moving forces which communicate the same velocity in a given time to different bodies, will be as the quantities of matter contained in the bodies moved. This will appear from a consideration of what has already been said concerning the momenta of bodies. For if one body contains ten times the quantity of matter that another does, it will of course require ten times as much force to move it with an equal degree of velocity; for the former is equivalent to ten such bodies, and it is the same thing whether they be separate or altogether.

13. The moving forces which act upon bodies, and the degrees of velocity communicated to them in a certain time, are proportional to the quantities of matter moved and the velocities communicated jointly; for, by the last proposition, when the velocity communicated in a certain time is the same, the moving force is as the quantity of matter moved. Thus, if a ball of ten pounds weight is made to move at the rate of 10 feet in a second, and another of one pound is made to move at the same rate, the moving forces will be in proportion to the quantities of matter; that is, as 10 to 1. Hence we may easily perceive, that when the quantity of matter is given, the moving force will be as the velocity. Thus, if two balls of ten pounds each

each

each are caused to move, one with the velocity of ten feet in a second, and the other with a velocity of five feet in the same time, the forces will be as the velocities; that is, as 10 to 5, or as 2 to 1; and hence, when both the quantities of matter and velocities are different, the moving forces will be according to these jointly. Thus if a ball of ten pounds is moved with a velocity of ten feet in a second, and a ball of one pound moves with a velocity of five feet in a second, the moving forces will be as 10×10 or 100 is to 1×5 , or as 20 to 1.

Here our author takes occasion to deny that there is any such thing as a communication of motion by an instantaneous impulse or stroke, as has commonly been supposed. Every degree of motion, according to him, is the effect of acceleration. "The latter way (says he) viz. the communication by instantaneous impulse, can obtain only in bodies perfectly hard and inflexible, which exist not in nature; and even in the abstract consideration of these as well as of other cases in mechanics, when metaphysical possibilities instead of the natural state of bodies are attended to, difficulties arise hardly explicable by any method of reasoning; but it is certain, that when finite velocity is communicated to any natural body, the time in which it is communicated must be finite also; so that when the body acted upon begins to move from quiescence, it must, during the action of the force, possess all the intermediate degrees of velocity between 0 and the velocity ultimately communicated.

"To exemplify this further, let it be supposed that a soft and flexible ball of clay impinges against another of the same sort, in the direction of a line joining the centres of the balls. At the first instant of the impact, the body struck will begin to move, and will proceed with a velocity inferior to that of the impinging body, the velocity of which will continue to decrease, and that of the other body to increase, as long as the impinging force causes a change in the figure of the two bodies; that is, till they have both acquired a common velocity; at which instant all acceleration ceases if the bodies be perfectly non-elastic. If the bodies be of such a kind, as, after having received impression from any impact, possess a power of restoring their changed figure with a force equal to that of the impact, it is manifest, that whatever velocity was communicated during the change of figure, an equal quantity will be superadded, during the restoration of it. In this case, after the acceleration arising from the impact during the change of the figure of the bodies has ceased, the bodies having then acquired a common velocity, a new acceleration will begin, being caused by the elastic force of the balls, which, acting in a direction of the lines joining their centres, tends to separate them, accelerating the ball struck, and retarding the other.

"From these considerations it appears, that in whatever degree the hardness of perfectly elastic bodies may differ, the effects of their impact will be the same, the weights and velocities before the stroke being given. For the figures of the striking and of the other body continually change, till they have acquired a common velocity, which depends only on the velocity of bodies and their impact, and is determined by the rules for the collision of non-elastic bodies. Moreover, the restoration of the changed figures, how great

or how small soever may have been the change, must cause an addition of velocity in the ball struck equal to that received from the impact.

"It follows also, that the effect will be the same, whether the bodies be both perfectly elastic, or whether one of them be perfectly elastic and the other perfectly hard; every thing else being given for the figure of the elastic body must change until the bodies have obtained a common velocity, which depends on the weights and velocities before the stroke only; and will be the same as if the bodies were non-elastic: the restoration of the figure will in this, as well as in the former case, cause an increase of velocity in the ball struck, equal to that before communicated. Although no substance in nature possesses perfect elasticity, or is entirely destitute of it, yet there are several elastic and non-elastic bodies subject to experimental trials, wherein the laws relating to collision are found to agree with fact to a considerable degree of exactness."

14. The accelerating forces which communicate velocity to bodies are directly as the moving forces, and inversely as the quantity of matter moved; for since by prop. 11. the accelerating force is as the velocity generated in a given time; and by prop. 13. the moving force is as the quantity of matter and velocity generated in a given time, it follows, that the moving force is as the accelerating force and quantity of matter moved jointly: that is, the accelerating force is as the moving force directly, and the quantity of matter moved inversely. Thus, let a mass of matter, equal to four ounces, be impelled by a force equal to three ounces; then the force which accelerates the mass of four ounces will be three-fourths when the acceleration of gravity is 1; in other words, it will generate, in a given time, three-parts in four of the velocity which gravity generates during any given time.

15. In bodies impelled in a rectilinear direction by forces acting uniformly, the velocities generated are as the forces and times in which they act, conjointly. Thus, suppose a force equal to ten acting upon a ball of ten pounds, and another also equal to ten acting upon a ball of equal weight, the former for one second, and the latter for two; it is plain that the velocity generated in the latter will be double to that generated in the former. But if we suppose the latter ball to be acted upon by a force equal only to five, then will both the velocities be equal, though the latter should continue for two seconds and the former only for one. In all practical inquiries of this kind, however, it must be remarked, that a standard velocity is to be obtained from observing what degree of velocity is generated by the force of gravity during a given time; one second, for instance.

16. If a quiescent body be impelled by any constant force acting upon it for a given time, the space described will be to the space described in the same time by a body moving uniformly with the last acquired velocity, in the ratio of one to two. In order to understand this, we must suppose the time to be divided into such small parts that the acceleration during any one of them is imperceptible: then it is evident, that at the end of two moments, the impulse continuing the same, it will have gained double the velocity it did the first moment; and this

Motion of Bodies. is manifest from the phenomena of falling bodies, which having descended for one second, acquire then a velocity twice as great as that which they had during the first second. That this proposition may be true, however, it is necessary that the velocity of the impelling power should be *infinite* with respect to that which the body itself can acquire; for whenever the body moved comes to acquire a velocity in any degree proportional to that of the moving power, then that proportion must be deducted from the acceleration; and when both come to be equal, no farther acceleration can take place. With regard to falling bodies, indeed, as far as our observations can go, were it not for the resistance of the air, this acceleration would go forward till the body had acquired a velocity much superior to any that we can now communicate, either by that or any other method. In all artificial accelerations, however, the velocity of the body moved soon becomes equal to that of the moving power, and then the motion goes on uniformly, which otherwise would continually increase.

17. The spaces which bodies describe from rest, by the action of constant forces, are in a compound ratio of the velocities last acquired and the times of motion: For the spaces described by the last acquired velocities continued uniform, are as those velocities, and the times of motion jointly; and the spaces described by the accelerating forces acting constantly for equal respective times, are half the former spaces by prop. 16. This will perhaps appear more intelligible from the annexed figure; in which the motion of a body, by an accelerated force, is represented by a triangle; for supposing the body to begin its motion from the point A, and to be uniformly accelerated until it arrived at the point C, it is plain that the velocity acquired would then be properly represented by the triangle ABC; but if the acceleration was then to cease, the velocity, and consequently the space passed over, would be represented by the parallelogram BCFE, double the triangle ABC. But let us suppose the acceleration still to go on, as is represented in the triangle BDF; it is plain that the space passed over in every small moment of time will be composed of a parallelogram formed by the velocity last acquired, and a triangle formed by the acceleration during that moment, which is entirely in terms of the proposition, that the spaces are in a compound ratio of the velocities last acquired, and the times of motion.

18. Constant forces which accelerate bodies, cause them to describe, from rest, spaces which are as the forces and squares of the times wherein they act jointly. For the spaces described are as the velocities last acquired, and the times of motion. This will be evident, from an inspection of the former figure; for in the triangle BDF, let B 1 represent the time in which a body acquires a certain velocity; then when it has attained the length of 2, the space passed over will be represented by a small square, being that of the first moment, and of a triangle representing the additional force the second moment.

19. The constant forces which accelerate bodies from a state of rest, are in a direct duplicate ratio of the velocities generated, and in an inverse ratio of the spaces described. Hence the following corollary is deduced, viz. that the last acquired velocities are in a subduplicate ratio of the accelerating forces, and a subduplicate ratio of the spaces described jointly.

20. If bodies unequal in quantity of matter be impelled from rest through equal spaces, by the action of moving forces which are constant, these forces are in a duplicate ratio of the last acquired velocities, and the ratio of the quantity of matter jointly.

In his observations on this proposition, our author takes occasion to consider the theory of those who insist, contrary to the opinion of Sir Isaac Newton that the absolute force of bodies is compounded of the quantity of matter and *square* of the velocity, instead of the velocity itself. "In the experiments (says he) which have been made on the force of bodies, the loss of motion from resistance has been more attended to than the communication of it by acceleration; and the reason probably arose from a want of adequate methods of subjoining accelerating forces, velocities acquired, and quantities of matter moved, to experimental trials; whereas the impact of bodies on fluids which they penetrate, by affording convenient opportunity for observing the depths to which bodies sink before all motion is destroyed, regard being had to the velocities of impact, and the weight and form of the impinging body, has seemed a more eligible method, however imperfect, of investigating the principles of motion.—When a body descends for three seconds by the force of gravity, it acquires, by a force of acceleration, a velocity of 96½ feet in a second: also, if a body be projected perpendicularly upward, with a velocity of 96½ feet in a second, the whole velocity will be destroyed in three seconds; and in like manner, every other property demonstrated concerning accelerated motions is found to belong to retarded ones, provided we attend to the following circumstances: If in any proposition relating to accelerated motion, the force is constant, it follows, that when this is applied to retarded motion, the retardation must also be constant. Moreover, since in accelerated motions the spaces are eliminated from quiescence, so in retarded motions the bodies are supposed to move to quiescence; that is, till all motion is destroyed by retardation: in whatever concerns motions of this kind, therefore, we must consider the retarding force to be directly as the force of resistance, and inversely as the quantity of matter.

"In order to illustrate this subject, it is to be observed, that if a body projected with different initial velocities be retarded by any constant given force, the whole spaces which the body describes are in a duplicate ratio of the initial velocities, which follows from what has been already demonstrated; and conversely, since when bodies are impelled by an accelerating force through various spaces, if these spaces are always as the squares of the last acquired velocities, it follows that the force of acceleration is constant: so when a given body is projected with different velocities, and is retarded by a given force, if the whole spaces described be always in a duplicate ratio of the initial velocities, it is concluded, that the force of retardation

Motion of
Bodies.

is constant. It is from this argument inferred, that the force whereby blocks of wood, banks of earth, &c. resist the penetration of bodies impinging on them, is constant; for it is observed, that the depths to which military projectiles of a given magnitude and weight, striking against a body of this kind, enter its substance, are in a duplicate ratio of the initial velocities, which has been sufficiently proved by Mr Robins, who first ascertained the velocities of military projectiles, and applied his method, among other useful purposes, to the discovery of the retardation which bodies suffer by passing through resisting substances.

"The forces of resistance, which are opposed to the motion of bodies impinging on substances which they penetrate, being granted constant, the propositions concerning acceleration already demonstrated may be applied to explain the motion of bodies, which, having been projected with given initial velocities, are interrupted by such obstacles as blocks of wood, banks of earth, or others of a similar kind.—For example, it has been demonstrated, that bodies moving from rest by the acceleration of constant forces, describe spaces which are as the accelerating forces and squares of the times jointly. By applying this proposition to retarded motions, we shall have the whole spaces or depths to which bodies impinging on the substances penetrate, as the forces of retardation and squares of the times wherein the bodies move, jointly. Moreover, it has been demonstrated, that if different quantities of matter be impelled from rest through equal spaces, the moving forces will be in a ratio compounded of the duplicate ratio of the velocities last acquired, and the ratio of the quantities of matter moved. It is from hence inferred, that in retarded motions also, if different quantities of matter be projected against any of the substances above described, with different initial velocities, and the whole depths to which the bodies penetrate are equal, the forces whereby the bodies resist the progress of the impinging bodies will be in a duplicate ratio of the initial velocities of impact and the quantities of matter jointly.

"By this proposition we may examine some of the experiments concerning the force of moving bodies, and the conclusions deduced from them by Bernoulli, Leibnitz, Poleni, &c. against the measure of force delivered by Sir Isaac Newton, which he described in the following definitions:

"The quantity of motion is measured by the quantity of matter in a moving body and its velocity jointly.

"The moving forces whereby bodies tend towards centres of attraction are as the quantities of motion generated in a given time.

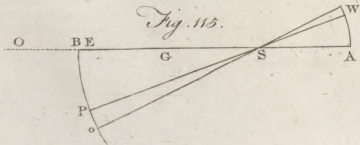
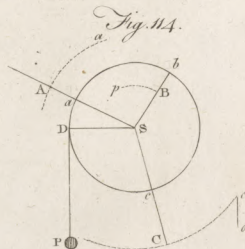
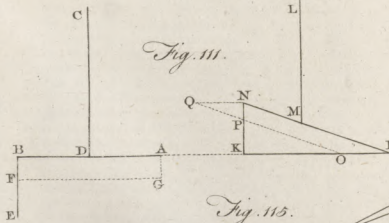
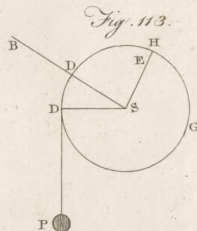
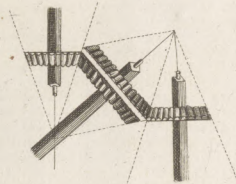
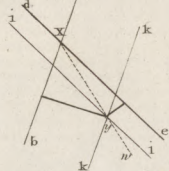
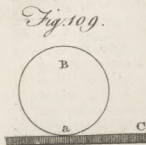
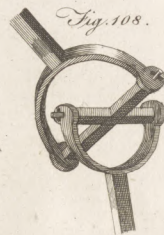
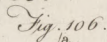
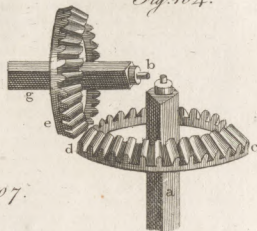
"It follows, then, from these definitions, that the moving forces, acting for a given time, will be proportional to the quantities of matter moved, and velocities generated, jointly: so that if the ratio of the moving forces be known, and we can find by experiment what velocities are generated in given bodies by the action of them for the same time; the quantities of motion generated in the bodies may be estimated according to Sir Isaac Newton's definition. Moreover, since it is allowed that the effects of a resisting force to destroy are the same as those of an equal force to generate motion in a given time; it follows,

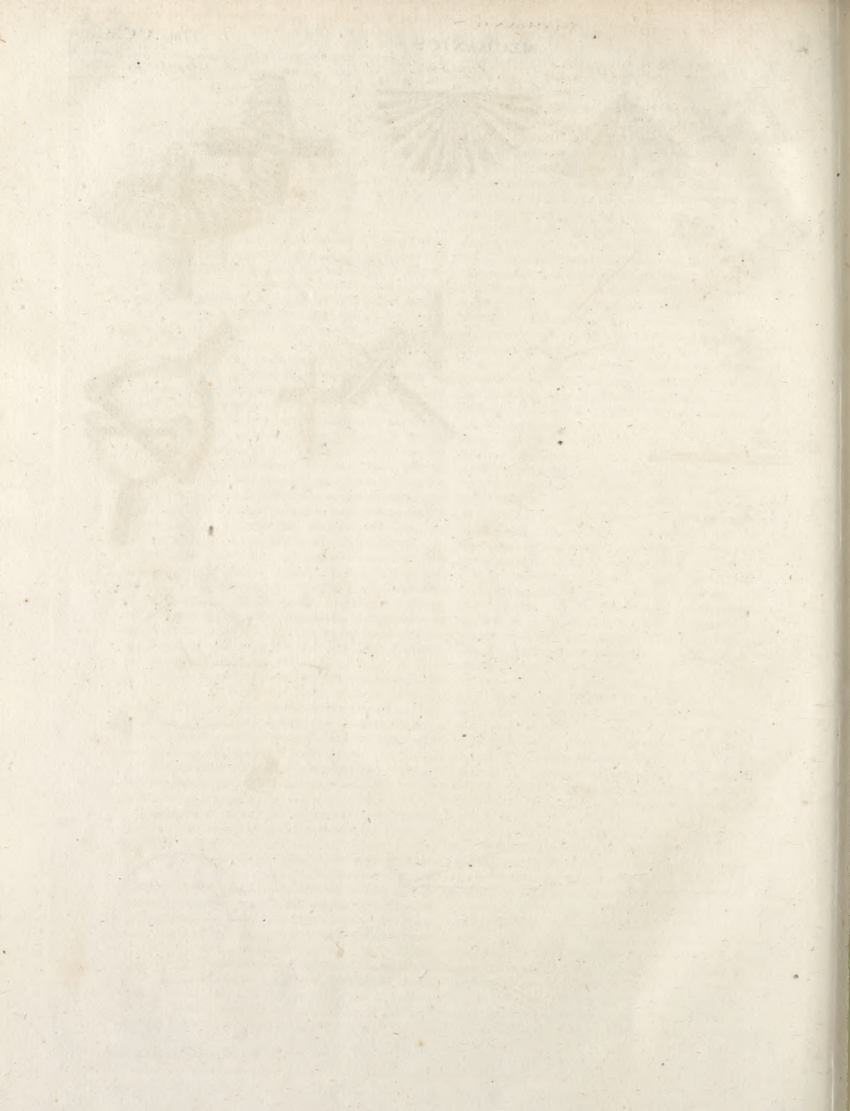
Motion of
Bodies.

that if the ratio of two resisting forces be known, the quantities of matter in bodies which impinge on substances, and penetrate them, and the velocities destroyed in a given time, will give the ratio of the quantities of motion destroyed, according to Sir Isaac Newton's definition.

"In many of the experiments alluded to, which have been greatly varied and multiplied, the resisting forces were made equal, by causing spheres equal in magnitude to impinge on a given substance which they penetrated; and the spheres being of given densities, it was observed in experiments, that whenever the densities or weights of those equal spheres were in an inverse duplicate ratio of their velocities, the depths to which they penetrated would be equal. The conclusions were these: the quantities of matter displaced by the moving bodies were equal, the depths to which the equal spheres penetrated were the same. Moreover, the whole motions which had been communicated to the bodies were destroyed; that is, the whole motion of the impinging bodies must have been as the squares of the velocities into the quantities of matter. But it plainly appears, that this conclusion is not applicable to the Newtonian definition, according to which the moving force generates motion in bodies: and it follows by what has preceded, that the resisting force by which the motion of bodies is destroyed, is proportional to the quantities of motion generated or destroyed in a given time respectively; and consequently, to estimate the quantity of motion destroyed, the time wherein resisting forces act should be equal. If, therefore, the times wherein the bodies in the experiment describe the equal spaces can be proved different, this will plainly show that the quantities of motion destroyed cannot be inferred from the experiment, the different times of the bodies describing the depths to which they sink not being taken into the account: this will be easily proved, since from proposition 17. it appears, that the spaces described are universally as the velocities and spaces last described jointly; and from what has been said, the converse of this proposition when applied to retarded motions must also be true. The spaces therefore being given as in the experiment, the times will be inversely as the initial velocities; which velocities being unequal from the experiment, it follows that the times are unequal. This being the case, it is manifest that no conclusion can be drawn from these experiments concerning the quantity of motion destroyed, tending to prove any inconsistency between the Newtonian estimation of force and matter of fact.

"It is next to be shown, that the experiments are strictly consistent with the Newtonian measure, and with the theory in general.—It has already been proved, that in accelerated motions the spaces described are in a duplicate ratio of the velocities last acquired, and the quantities of matter moved, and an inverse ratio of the moving forces. This proposition being applied to retarded motions, it will follow, that the whole spaces or depths to which the impinging bodies sink, are in a duplicate ratio of the quantities of matter, and an inverse ratio of the resisting forces; whence also the depths to which the bodies penetrate must be equal when spheres of equal diameters are projected against a given substance, the weights being in an inverse duplicate





Motion of
Bodies.Motion of
Bodies.

duplicate ratio of the initial velocities, which we find entirely correspondent to experiment. It seems indeed rational to suppose, independent of all theory, that, in estimating the quantities of motion generated or destroyed by given moving or resisting forces, regard must be had to the times wherein the forces act; because moving forces, or those of resistance, may be equal, and may generate or destroy quantities of motion varying in any assignable degree. For it is manifest, that a small resistance, opposed to a moving body for a longer time, may destroy more motion than a greater force acting for a shorter time; which sufficiently shows, that the times wherein the moving and resisting forces act, must either be equal, or must be taken into the account in estimating the quantities of motion generated or destroyed.

21. The moving forces which communicate, and the forces of resistance which destroy, the motion of bodies in the same time, will be in a compound ratio of the quantities of matter in the moving bodies and velocities generated or destroyed.—This and the preceding propositions have been fully illustrated and confirmed by experiments. From them we deduce the following facts: 1. When musket-balls, equal in weight and magnitude, impinge on a block of wood with different velocities, the resisting force being constant, we shall have the whole spaces through which the balls move in the wood as the squares of the velocities. 2. If balls of equal diameters, but different weights, impinge against a block with the same velocity, we have the depths to which they penetrate the block as the weights. 3. If balls of the same kind of substance, that is, of the same density, but of different diameters, impinge against a given block of wood or the same bank of earth with equal velocities, the depths to which they penetrate will be directly as the diameters of the balls.

When the force of resistance is not uniform, the same principle obtains in degree, though the laws are then various; for greater bodies always suffer less by retardation than smaller ones of the same density, moving through the same resisting medium, and projected with a given initial velocity: because, though the force of resistance increases with the increase of the body's magnitude, yet the weight in most bodies increases in a greater proportion. Thus, in cannon-balls, and other solid bodies, though the resistance of the air increases as the square of the ball's diameter, yet the weight increases as the cube. Thus, if a ball two inches in diameter is projected from the mouth of a piece, it is resisted by the atmosphere four times less than one four inches in diameter; but the weight of the latter, being eight times greater, makes the resistance less upon the whole in the large ball than in the small one. It is otherwise when the weight does not increase in this manner; for then the smaller the body is, the less resistance it meets with, and the faster it goes. This is manifest from aerostatical experiments; for small air-balloons always outstrip the larger ones: and the same thing is observable in boats; for the smaller ones, if they have the same advantages in proportion to their bulk, will always sail faster than the larger ones.

22. If bodies, projected with the same velocity, be retarded by different constant forces, these forces will be in an inverse ratio of the whole spaces described by

the projected bodies, until all motion is destroyed.—For example, let a body be projected on an inclined plane, in a direction contrary to that in which gravity acts in the plane, and with a velocity of 144.467 inches in a second. Suppose the body then projected, ascending along the plane, to describe 216 inches before its motion is destroyed; let it be required to ascertain the retarding force which opposes its ascent, that is, the proportion of it to the force of gravity. If the body were projected perpendicularly upward, with the given velocity of 144.467 inches in a second, it would rise only to 27 inches, as follows in Prop. 19. And since it ascends along the plane 216 inches, the retarding force on the plane will be to that of gravity as 27 to 216, or as 1 to 8; which is also the proportion of the height of the plane to the length of it.

From this proposition, having given the depth to which a body impinging against another penetrates it, the proportion of the retarding force of gravity may be determined. For example, Mr Robins found that a leaden ball of $\frac{3}{4}$ of an inch, or $\frac{1}{8}$ of a foot in diameter, impinging on a block of elm with a velocity of 1700 feet in a second, penetrated it to the depth of five inches, or $\frac{1}{4}$ of a foot; wherefore, since a body projected upwards with a velocity of 1700 feet in a second, would rise, if the atmosphere made no resistance, to the height of 44922 feet, we have the force by which elm retards the ball to the force of gravity as 44922 to $\frac{1}{4}$; or as 107,813 to 1.

On this theory it may further be observed, that the resistances opposed to spherical bodies, which impinge on a block of wood, a bank of earth, &c. depend not only on the tenacity or density of the parts, of which the penetrated substances are composed, but upon the diameters of the impinging spheres: so that, although the resisting and retarding forces be determined in any substance for a single case; yet when the diameters and weights of the impinging bodies vary, the forces of resistance and retardation opposed to the impact on the same substance will be different. By the preceding proposition, however, we may be enabled, from a single experiment made on the retardation of any substance opposed to a sphere, the weight and diameter of which are known, to infer the retardation in any other case, however the weights and diameters may vary.

23. If spheres of different diameters and different specific gravities impinge perpendicularly on fixed obstacles, the resisting forces of which are constant, but of different quantities, the forces which retard the progress of the impinging spheres will be in a direct ratio of the absolute forces of resistance, and the joint inverse ratio of the diameters and specific gravities of the spheres. No absolute conclusion can be drawn from this proposition concerning any matter of fact, unless an experiment be first made on the retarding and resisting force of some substance which is to be considered as a standard.

24. The whole spaces or depths to which spheres, impinging on different resisting substances, penetrate, are in the ratio compounded of the duplicate ratio of the velocities of impact, the joint ratios of the diameters and specific gravities of the spheres, and an inverse ratio of the absolute forces whereby the substances resist the progress of the spheres.

Motion of
Bodies.

Mr Atwood concludes this section with some problems relative chiefly to military projectiles; and in his next section (the 4th) considers the rectilinear motion of bodies acted upon by forces which vary in some ratio of the distances from a fixed point. This section chiefly relates to the powers of gravity and projection, by which the celestial bodies are actuated, and which consequently chiefly regards astronomy and the motion of pendulums; though there are likewise some curious particulars relating to the action of compressed air, the vibration of musical strings, and the undulation of fluids. The fifth section considers the motion of bodies immersed in fluids; but the sixth treats of a subject which properly belongs to mechanics, viz. the communication of motion to bodies revolving round an axis.

69
Of rotatory
motion.

In treating this subject Mr Atwood observes, that in the former part of his work he had supposed the accelerating, as well as resisting, forces, to act upon the body in a straight line passing through the centre of gravity of the moving; in which case every particle of the body must partake of the same degree of velocity, being equal to that with which the common centre of gravity moves. "But (says he) it frequently happens, that a body, or system of bodies, is so constituted, that when any force is impressed upon it, no motion can be produced except round a fixed axis; so that the velocity of the particles which compose the system will be greater or less according as these particles are farther from the common axis or nearer it. These circumstances should be attended to, in order to ascertain the motion of revolving bodies; the preceding principles of acceleration being not wholly of themselves sufficient for that purpose.

"In this investigation two things must be attended to. 1. The moving force by which the revolving motion is generated; and, 2. The inertia of the parts of which the system is composed. The moving force exerted on any given particle of the system, as well as its inertia, depends on its distance from the axis of motion, every thing else being the same; and if both these be ascertained, the absolute acceleration of the particle will be determined, and consequently the absolute velocity generated in a certain time. The methods therefore of determining these forces in any given circumstance should next be described.

"Let AFGH (fig. 112.) represent the circumference of a wheel which turns in its own plane round an horizontal axis, passing through its centre; and let a weight P, fixed at the extremity of a line AP, communicate motion to the wheel. Moreover, let the whole weight of the wheel be Q; and suppose this weight to be collected uniformly into the circumference AFGH; then, during the descent of the weight P, each point of the circumference must move with a velocity equal to that with which P descends; and consequently, since the moving force is the weight P, and the mass moved P+Q, the force which accelerates P in its descent will, by Prop. 14. be that part of the accelerating force of gravity which is expressed by the

fraction $\frac{P}{P+Q}$. The velocity, therefore, which is generated in P in any given time, is found from the rules before demonstrated. Thus, supposing Q to be

Motion of
Bodies.

equal to P, then will $\frac{P}{P+Q} = \frac{1}{2}$; and the weight P will be accelerated by a power which is to that of gravity as 1 to 2; and since gravity generates in bodies which descend for one second of time near the earth's surface a velocity of 32½ feet in a second; it follows, that the weight P will in the same time have acquired a velocity of 16½ feet in a second only.

"The parts of the weight Q which are uniformly disposed over the circumference AFGH, balance each other round the common centre of gravity S; their weight therefore is of no effect in accelerating or retarding the descent of P: and this will be the case whenever the axis of motion passes through the common centre of gravity. But in order to render the properties of rotatory motions more obvious, it will be convenient to dispose the parts of the revolving system so that the axis of motion shall not necessarily pass through the common centre of gravity: thus, instead of having the weight Q uniformly disposed over the circumference AFGH, let it be collected into any point Q. Here it is manifest, that if the mass Q be acted upon by gravity, the force which communicates motion to the system round S will be variable, it being the greatest when SQ is horizontal, and gradually diminishing till Q has arrived at its lowest point. But as we should begin with the most simple cases, the moving force must be constant. This will be effected by supposing the mass which is collected in Q to be destitute of weight, and to possess inertia only. It follows therefore, that during the revolution of Q round S as an axis, the moving force will be constantly equal to P, and the mass moved = P+Q. Consequently the force which accelerates the descending weight, or any point in the circumference, will be that part of gravity which is expressed by the fraction $\frac{P}{P+Q}$ as before.

"In these cases, the force which communicates motion to the system has been supposed a weight or body acted upon by the earth's gravity, and consequently constitutes a part of the mass moved, at the same time that it acts as a moving force: but motion may be communicated by a force which shall add nothing to the inertia of the matter moved: and it will be convenient in many demonstrations to assume the force of this kind; and in this case we have not to take the inertia into the account. Thus if any number of bodies without gravity collected into the points F, H, Q, (fig. 112.) are caused to revolve round the axis S, by a moving force P, the force which accelerates these bodies in their revolution will be $\frac{P}{F+H+Q}$; provided the bodies F, H, Q, be disposed at a distance from the axis of motion equal to the radius of the circle AFGH, at the circumference of which the moving force P is applied.

"In the preceding example, F, H, Q, &c. have been supposed to move with the same velocity; but when bodies revolve at unequal distances from the axis, their velocities of motion being different, other rules will be necessary to determine the force whereby any given point of the system is accelerated. In demonstrating the properties of rotatory motion, the revolving

Motion of Bodies. A moving system may be supposed to consist of one or more of the bodies A, B, C: the magnitude of these may be supposed evanescent; because, were the contrary supposition adopted, the particles in each body would be impelled by different moving forces, and exert different degrees of inertia in opposition to the communication of motion. But the force which impels each individual particle, and the effects of its inertia in different circumstances, must be known before the acceleration of the whole system can be determined.

"The bodies A, B, and C, which may be termed, according to the ideas just described, material points, are imagined to be connected together by some perfectly rigid substance, so as always to possess the same situation in respect to each other: and consequently no motion can be produced in any of them, excepting that all revolve at the same time round the common axis of motion.

"All the points in this imaginary subfiance, by which the parts of the system are connected together, partake of the same angular motion, describing circles round the common axis S. A force P therefore being applied to any point in the plane of its motion, and in the direction of any line in that plane which passes not through the axis, will communicate an equal angular motion to the whole. Thus let B (fig. 115.) represent a material point moveable about an axis of motion passing through S. With the radius SD describe a circle DGH. Now if B be connected with every point in the area of this circle, which is an inflexible subfiance, no force can be applied to move the circle but what must communicate the same angular motion to B. Let the force be applied at the point D; it is manifest, that in order to render its effects constant, the inclination of its direction to SD must be always the same, and in a given plane; and the most obvious method of effecting this, either in considering the subject theoretically, or in the practical illustration of it, is by applying a thin and flexible line GHDP round the circumference of the circle DGH, and stretching this line by a given moving force P. Here it is plain, that in whatever part the point D is situated, the effects of the force P will be the same as if it were directly applied to D in the direction of the plane of motion, and perpendicular to SD, and the point B will revolve with the same absolute and angular velocity in both cases.

Let now ABC (fig. 114.) be a fyflem of bodies of evanefcent magnitude and without gravity, moveable about an axis of motion which paffes through S it muft be obferved, that the imaginary fubftance by which the parts of the fyflem ABC are connected, muft contribute nothing either by its weight or inertia to accelerate or retard the motion of the material points A, B, C, which are caufed to revolve by the action of the given and conflant force P, applied at the diftance from the axis SD. The abfolute force of P to move D, or any point of the circumference, will be P; but the communication of motion to this point D is refifted by the inertia of the bodies A, B, C; which being moved with different velocities, and acted on by different moving forces, their inertia will not be eliminated by their quantities of matter only, according to the laws obferved in rectilinear motion; the force

which accelerates D , therefore, cannot be obtained by dividing P by $A+B+C$; but if an equivalent mass, or a quantity of matter, can be assigned, which being collected into any points of the circumference a, b, c , will cause an inertia or resistance to the motion of D equal to that exerted by the particles A, B, C , when revolving at their respective distances, the force which accelerates the circumference or any point in it D will be determined. Thus, let the mass Q , when collected into a , be such as will be equivalent in its inertia to A , when revolving at the distance SA ; also let R be the mass collected into b , which is equivalent to B when revolving at the distance SD ; and let T , the mass collected into C , be equivalent to C when revolving at the distance SC ; then will the mass moved by the force P be $Q+R+T$; and the force which accelerates the circumference $= \frac{P}{Q+R+T}$, being equal to

that by which the circumference or any point in it is accelerated when the point consists of A and B and C, revolving at the respective distances from the axis of motion SA, SB, SC."

Our author now proceeds particularly to investigate the motion of revolving bodies in almost all possible circumstances, deducing from his propositions many conclusions very useful in practical mechanics. Many of these regard the pendulum, and are therefore taken notice of under that article; others more immediately relate to the parts of mechanics particularly treated of in this article: the principal of which follow.

1. The force which accelerates the centre of gravity of a sphere, while it rolls down an inclined plane, is to the force by which it would be accelerated were it to slide in the ratio of five to seven. As our limits will not admit of inferring at length the demonstration of this and other propositions, we shall in this only observe, that when a wheel or a sphere *roll*, the circumference goes backward, while the centre moves forward; which retrograde motion must of necessity make the other slower than it would otherwise be: and this retardation Mr Atwood has determined to be in the proportion above-mentioned.

From this proposition the following corollaries are deduced. 1. The absolute force whereby motion is generated in the circumference of a sphere in such a situation, is expressed by a fraction consisting of twice the weight of the sphere divided by seven, and multiplied into another fraction consisting of the height of the plane divided by its length; that is, suppose the weight of the sphere to be represented by w , the height of the plane by h , and its length by l , the force by which the circumference of the sphere is impelled will be represented by $\frac{ew}{7} \times \frac{h}{l}$. 2. In the same man-

ner, let a cylinder roll down an inclined plane, keeping the axis always horizontal, and the force which accelerates the axis will be represented by the fraction $\frac{2}{3} \times \frac{h}{l}$.

2. Let AB (fig. 115.) represent a straight lever moveable round an horizontal axis of motion, which passes through S . Let the arms be SB, SA . Suppose a weight W to be affixed to the extremity of the

Motion of
Bodies.

70
Of revol-
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Motion of
Bodies.

shorter arm, and to be raised by the weight P applied at the extremity of the longer arm, when the lever is horizontal. Required to determine the time in which W will be raised through any given height, the weight and inertia of the lever itself not being considered.

"When there is an equilibrium (says Mr Atwood) on any mechanic power, the proportion of the weight sustained to the power sustaining it, will, in all cases, be assigned from having given the dimensions of the mechanic power. An equilibrium having been once formed, the smallest addition of weight will cause the body to which it is applied on either side to preponderate. In this case a certain degree of motion is generated; and since the uses of the mechanic powers are not only to sustain forces in equilibrium, but to raise weights and overcome resistances, it is a problem of principal consequence to assign the absolute quantity of motion generated by a known moving force in given circumstances." The general solution of the problem is as follows:

"Let AB be the lever, W the weight moved by the power P; each acting in a direction perpendicular to the horizon. Let G be the common centre of gravity of the whole system, including the weights P and W with the lever itself; and o the centre of oscillation*, when AB vibrates round the axis S; the force which accelerates B when the lever is horizontal

$$= \frac{SG \times SB}{SO} = \frac{SB}{SO} \quad (c). \quad \text{If this be put } = F, \text{ the time}$$

wherein P descends through a perpendicular space x , and consequently wherein W ascends through the corresponding space; then $x \times \frac{SA}{SB} = \frac{\sqrt{x}}{F} \times \frac{1+x^2}{SB^2 \cdot 2.5}$

$$\&c. = \frac{\sqrt{x}}{T} \times \frac{SO}{SB} \times \frac{1}{1 + \frac{x^2}{SB^2 \cdot 2.5}}, \&c.$$

3. Let ABC (fig. 116.) represent a wheel and axle, its weight w , and let the axis be horizontal; having a given weight Q applied to the circumference of the axle, and P applied to the circumference of the wheel in order to raise Q. Required to assign the space described by the elevated weight Q in any given time. The solution of this problem, without attending to the demonstration, is this. Having found the accelerating power, which here is

$$\frac{P \times SD - Q \times SA \times SA}{w \times SR^2 \cdot (e) + P \times SD^2 + Q \times SA^2}$$

All this he puts $= F$; and then l being = 193 inches as before, the space described by Q in any number of seconds will be = the square of that number of seconds multiplied into F . On this proposition our author makes the following observations.

"Whenever motion is communicated to a body, a certain resistance must have been overcome by the moving force. This resistance is of various kinds. 1. The inertia of the mass moved, whereby it endeavours to persevere in its state of quiescence, or of uniform motion in a right line. 2. That of a weight or other

absolute force opposed to the action of the moving power. 3. Obstacles upon which the moving body impinging is retarded in its progress: such, for example, is the resistance which arises from the particles of a fluid thro' which a body moves. The estimation of these resistances, and their effects in retarding the motion of bodies acted on by a given force, are deducible from the laws of motion, and constitute a part of the solution of almost all problems relating to the motion of bodies.

"The moving forces also are of various kinds, viz. The power of gravity, muscular power, the impact of bodies, solid and fluid, &c. It has been shown, that the effects of these moving forces which are exerted on bodies in order to create motion, exclusive of the resistance opposed to them, depend on the various circumstances of the time in which they act, and on the spaces through which the bodies moved are impelled, &c.

"These considerations are urged, to show, that from the great variety of undetermined conditions which may enter into mechanical problems, there must of course be various methods of producing the same mechanical effect: and it is a very material part of the art, considered either in a theoretical or practical view, to proportion the means to the end, and to effect this with all the advantages which the nature of the case is capable of. It is the due observation of these particulars which contributes to render mechanic instruments complete, and the neglect of them defective, in their construction. This proper choice of means to produce mechanical effects, is frequently the result of long continued experience independent of all theory; the knowledge of which, however, when applied to practice, would save the artist much time and trouble, as well as would be productive of other advantages, which experience alone must be destitute of."

4. ABC (fig. 116.) is a wheel and axis moveable round an horizontal axis, which passes through S. Suppose a given weight Q, which is applied to the circumference of the axle; let it be required to assign the proportion of the radii of the wheel and axle, so that the time in which the weight Q ascends through any given space shall be the least possible. In this case, supposing the radius of the wheel to be 10 inches, and its weight 20 ounces; let the radius of the axle SA = 1 inch, the weight to be raised thro' any given space to be 100 ounces, the moving force by which it is raised to be 33 ounces; then the distance of the centre of gyration from the axis is $\sqrt{50}$ inches; and the length of the radius sought is 9.55 inches.—If, instead of raising the weight perpendicularly, it be required to draw it horizontally, and to assign the distance SD, at which, if a given force P be applied, the time of describing a given space shall be the least, and the moment of g the greatest possible, we have the following conclusion. "Let the quantity of matter to be drawn along the plane be four times greater than that which is contained in the moving

Motion of
Bodies.

* See Pendulum.

73
On the
wheel-
axle.
Plate
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(c) This he had formerly proved when treating of pendulums.

(d) l is here put for 193 inches, the supposed velocity of the weight P.

(e) R is the centre of gyration of the wheel.

Motion of Bodies,
 ing force; the radius of the axle SA being given; in order that it may be impelled with the greatest velocity possible and with the greatest moment, the radius of the wheel should be double that of the axle when the inertia of the wheel is not considered.

5. Let ARCH (fig. 117.) be a system of bodies moveable round a vertical axis which passes through the common centre of gravity of the system. Suppose DEG to be a wheel, the axis of which is vertical, and coincident with that of the system; let motion be communicated by means of a line going round this wheel, the string DP being stretched by a given weight P; let it be required to assign the radius of the wheel EGD, so that the angular velocity communicated to the system may be the greatest possible. Here, supposing the moving force to be one-fourth of the weight of the system, it should be applied at a distance from the axis equal to twice the distance of the centre of gyration, in order to produce the greatest possible angular velocity in a given time.

"In order (says Mr Atwood) to increase the action of a moving force against a weight to be raised, or resistance to be overcome, a combination of two or more mechanic powers is frequently made use of. Let p (fig. 118.) be a power applied by means of a line to the vertical wheel C: suppose the circumference of the axle K to be in contact with the circumference of any other vertical wheel B; so that the circumference of the wheel B may always move equally fast with that of the axle which belongs to C; let also the axle of B communicate motion to a vertical wheel A, to the axle of which a weight q is suspended, so as to act in opposition to p ; moreover, let the ratio of $l m n$ to 1 be the sum of the ratios of the radius of each wheel to that of its axle: then, if $p l m n = q$, the two weights p and q will sustain each other in equilibrium; but if $p l m n$ be at all greater than q , the equilibrium will be destroyed;" and our author gives a method of calculating the quantity of motion communicated in certain circumstances.

Our author next goes through a set of similar propositions relating to the pulley and wedge; after which he treats of the accumulation of power in ponderous cylinders, and the use of balast-wheels in machines, of which mention has already been made; and having diffused these subjects, he next comes to treat of the action of a stream of water upon a wheel revolving round an horizontal axis.

6. Let ABC (fig. 119.) represent a water-wheel which revolves round an horizontal fixed axis, passing through its centre S. Suppose DEF to be the axle of this wheel, and that a weight W is affixed to a line DW, so wound round the axle, that while the wheel is driven round its own plane by the force of the water impinging at I, the weight W may be raised in a vertical line; having given the area of the boards II, against which the stream impinges perpendicularly, and the altitude from which the water descends, it is required to assign the greatest velocity with which the wheel can revolve.

"When a stream of any fluid (says he) impinges perpendicularly against a plain and quiescent surface, the exact quantity of the moving force is equal to the weight of a column of the fluid, the base of which is the area upon which the fluid impinges, and the alti-

tude that from which a body must descend freely from rest by gravity, in order to acquire that velocity. This will be the moving force which impels the body when quiescent or just beginning to move: but after it has acquired some motion, the impulsive force of the body will be diminished; being the same as if the body were quiescent, and the water impinged upon it with the difference of the former velocities. Wherefore the altitude of the column of the fluid, which is equal to its impelling force, will be always as the difference between the velocity of the impact and that of the body itself; and since the altitudes from which bodies fall from rest are in a duplicate ratio of the velocities acquired, it follows, that the force of the impact will be in a duplicate ratio of the difference between the velocity of the wheel and that of the impact." The following is the conclusion drawn by Mr Atwood concerning the velocity: Putting A for the weight of the column of water when the wheel is quiescent; V the velocity with which it impinges on the boards II, &c. and y the velocity of the circumference sought; W

the weight of the wheel; then $y = V - V \times \frac{\sqrt{W} \cdot SD}{A \times ST}$.

7. Every other thing remaining the same, let the weight W be varied; and let it be required to assign the weight W, so that when the wheel has acquired its uniform velocity, the moment of W may be the greatest possible. Here the weight = $\frac{4 \times A \times SI}{9SD}$.

8. Having given a weight W to be raised by the action of the stream of water, the force of which is = A against a quiescent surface; let it be required to assign what must be the proportion between the radius of the wheel and that of the axle; so that the uniform velocity of the ascending weight may be the greatest possible. Here the length of the radius = $\frac{9W \times SD}{4A}$. Hence he concludes, that if the velocity with which the water impinges against the boards be doubled, the greatest moment communicated to a weight ascending uniformly, will be increased in the proportion of 8 to 1.

"The force (says Mr Atwood) which communicates motion to water-wheels, and the resistances which are occasioned by friction, tenacity, and various other causes, render the application of the theory of mechanics to practice, in these cases, extremely difficult. It is probably from this reason, that the construction of machines moved by the force of water, &c. has been almost wholly practical, the best improvements having been deduced from continued observation of the results produced in given circumstances; whereby the gradual correction of error, and varied experience of what is most effectual, have supplied the place of a more perfect investigation from the laws of motion.

"This seems to be the best method, as far as regards the practical construction of these machines, the nature of the case will admit of; for although there may be two ways leading ultimately to the same truths, i. e. a direct investigation from the laws of motion and long continued observation, independent of theory, the latter is frequently the most easy and intelligible, although less direct and less scientific; the former being inaccessible to those who possess the elementary

Motion of Bodies.

78

Atwood's observations on water-mills.

Motion of
Bodies.

mentary parts of mechanics only. It is in vain to attempt the application of the theory of mechanics to the motion of bodies, except every cause which can sensibly influence the moving power and the resistance to motion be taken into account: if any of these be omitted, error and inconsistency in the conclusions deduced must be the consequence. It was at one time supposed, from this inadequate application of the theory, that the same laws of motion would not extend to all branches of mechanics, but that different principles were to be accommodated to different kinds of motion. If this were truly the case, the science of mechanics would fall short of that superior excellence and extent which it is generally allowed to possess. For it is probable, that there is no kind of motion but what may be referred to three easy and obvious propositions, the truth of which it is impossible to doubt: and if we are not enabled to investigate the effects from the data in all cases, the deficiency must not be imputed to the science of mechanics, but to the want of methods of applying mathematics to it.

"This may be illustrated by an example, in order to show that the motion communicated to water-wheels, however complicated the data may be, is equally referable to the laws of motion, with the effects of the most uncompounded force. If a stream of water falls perpendicularly on a plain surface, the moving force arising from the impact only is equal to the weight of a column of water, the base of which is the surface upon which the water impinges, and altitude that through which a body must fall to acquire the velocity of impact. If the inclination of the stream to the surface should be changed, the force exerted in a direction perpendicular to the plane will be diminished in a duplicate ratio of the radius to the sine of inclination; the surface on which the water impinges remaining. Now, when the water falls on the boards of a water-wheel, the direction of the stream makes different angles with the planes of those boards; for since the particles of water descend in curve lines, they will strike any plain surface in the direction of a tangent to the curve on the point of impact. Moreover, the water will strike the higher boards TT with less velocity, and in a direction more inclined to their planes, than the lower ones II; it is also to be considered, that the stream will impinge on the boards at different distances from the axis of motion: all which circumstances must be taken into account, to find the force which tends to communicate motion to the wheel when quiescent; and when motion has been communicated, the force of the stream to turn the wheel will be determined in the manner already mentioned. But this is not the only consideration which affects the moving force: The force hitherto considered has been supposed to proceed from the impact of the particles only; in which case, each particle after it has struck the board is imagined to be of no other effect in communicating motion: but this is not wholly the case; for after the particle has impinged on the board, it will continue some time to operate by its weight; and this time will be longer or shorter according to the different constructions of the wheel. In the overshoot wheel, the continuance of the pressure, arising from the weight of the water, will be longer than in the undershot,

Fig. 119.

Motion of
Bodies.

the force which arises from the impact of the water being nearly the same in each case. The whole moving force, therefore, will consist of the impact determinable as above, and of the weight of the water descending along with the circumference, and communicating additional motion to it: this entire moving force being determined either by theory or experience, may be denoted by A. After the moving force which impels the circumference has been determined, the resistance to this force must be found; for on the proportion between the moving force and the resistance, the acceleration of the machine will depend. This resistance is of various kinds: 1. That of inertia. 2. If the machine is of that kind which raises weights, such for instance as water; the weight raised, allowing for its mechanical effect on the point of which we desire to know the acceleration, must be subtracted from the moving force before found; and this will be a constant quantity. There are other resistances all homogeneous to weight, viz. those of friction and tenacity, &c. which are variable in some ratio of the machine's velocity: and in order to proceed with the investigation, the exact quantity of weight which the friction is equal to, when the wheel moves with a given velocity, must be considered, as well as the variation of the resistances in respect to the velocities; which circumstances must be determined by experiment. If the force equivalent to the friction, &c. be subtracted from the moving force, the remainder will give the moving power, by which the circumference is impelled upon the whole: this being divided by the inertia of the mass moved, will give the force which accelerates the circumference.

The following apparatus has been invented by Mr Atwood, for illustrating his doctrines concerning accelerated motion, and has been found to answer the purpose more completely than any other we have heard of; discovering at once the quantity of matter moved, the force which moves it, the space described from rest, the time of description, and the velocity acquired.

1. *Of the mass moved.*—In order to observe the effects of the moving force, which is the object of any experiment, the interference of all other forces should be prevented: the quantity of matter moved, therefore, considering it before any impelling force has been applied, should be without weight; for although it be impossible to abstract the natural gravity or weight from any substance whatever, yet the weight may be so counteracted as to be of no sensible effect in experiments. Thus in the instrument constructed to illustrate this subject experimentally, A, B, fig. 120, represent two equal weights affixed to the extremities of a very fine and flexible silk line; this line is stretched over a wheel or fixed pulley *abcd*, moveable round an horizontal axis: the two weights A, B, being precisely equal and acting against each other, remain in equilibrium; and when the least weight is superadded to either (setting aside the effects of friction), it will preponderate. When AB are set in motion by the action of any weight *m*, the sum $A+B+m$ would constitute the whole mass moved, but for the inertia of the materials which must necessarily be used in the communication of motion: these materials consist of,

1. The

72
His apparatus
for experiments
on motion.

1. The wheel *abcd*, over which the line sustaining A and B passes. 2. The four friction wheels on which the axle of the wheel *abcd* rests: the use of these wheels is to prevent the loss of motion, which would be occasioned by the friction of the axle if it revolved on an immovable surface. 3. The line by which the bodies A and B are connected, so as when set in motion to move with equal velocities. The weight and inertia of the line are too small to have sensible effect on the experiments; but the inertia of the other materials just mentioned constitute a considerable proportion of the mass moved, and must be taken into account. Since when A and B are put in motion, they must necessarily move with a velocity equal to that of the circumference of the wheel *abcd* to which the line is applied; it follows, that if the whole mass of the wheels were accumulated in this circumference, its inertia would be truly eliminated by the quantity of matter moved; but since the parts of the wheels move with different velocities, their effects in resisting the communication of motion to A and B by their inertia will be different; those parts which are furthest from the axis resisting more than those which revolve nearer in a duplicate proportion of those distances. If the figures of the wheels were regular, from knowing their weights and figures, the distances of their centres of gyration from their axes of motion would become known, and consequently an equivalent weight, which being accumulated uniformly in the circumference *abcd*, would exert an inertia equal to that of the wheels in their constructed form. But as the figures are wholly irregular, recourse must be had to experiment, to assign that equivalent quantity of matter, which being accumulated uniformly in the circumference of the wheel *abcd*, would resist the communication of motion to A in the same manner as the wheels.

In order to ascertain the inertia of the wheel *abcd*, with that of the friction wheels, the weights AB being removed, the following experiment was made.

A weight of 30 grains was affixed to a silk line (the weight of which was not so much as $\frac{1}{10}$ th of a grain, and consequently too inconsiderable to have sensible effect in the experiment); this line being wove round the wheel *abcd*, the weight 30 grains by descending from rest communicated motion to the wheel, and by many trials was observed to describe a space of about 38 $\frac{1}{2}$ inches in 3 seconds. From these data the equivalent mass or inertia of the wheels will be known from this rule:

Let a weight P (fig. 121.) be applied to communicate motion to a system of bodies by means of a very slender and flexible line going round the wheel SLDIM, through the centre of which the axis passes (G being the common centre of gravity, R the centre of gravity of the matter contained in this line, and O the centre of oscillation). Let this weight descend from rest through any convenient space *l* inches, and let the observed time of its descent be *t* seconds; then if *l* be the space through which bodies descend freely by gravity in one second, the equivalent weight sought = $\frac{W \times R \times SO}{SD^2} = \frac{P \times l^2}{t^2} \cdot P$.

Here we have $P = 30$ grains, $t = 3$ seconds, $l = 193$

$$\text{inches, } t = 38.5 \text{ inches; and } \frac{P \times l^2}{t^2} = \frac{30 \times 193^2}{38.5^2}$$

$$30 = 1323 \text{ grains, or } 23 \text{ ounces.}$$

This is the inertia equivalent to that of the wheel *abcd*, and the friction wheels together: for the rule extends to the elimination of the inertia of the mass contained in all the wheels.

The resistance to motion therefore arising from the wheel's inertia, will be the same as if they were absolutely removed, and a mass of 23 ounces were uniformly accumulated in the circumference of the wheel *abcd*. This being premised, let the boxes A and B be replaced, being suspended by the silk line over the wheel or pulley *abcd*, and balancing each other: suppose that any weight *m* be added to A so that it shall descend, the exact quantity of matter moved, during the descent of the weight A, will be ascertained, for the whole mass will be $A + B + m + 23 \text{ oz.}$

In order to avoid troublesome computations in adjusting the quantities of matter moved and the moving forces, some determinate weight of convenient magnitude may be assumed as a standard, to which all the others are referred. This standard weight in the subsequent experiments is $\frac{1}{2}$ of an ounce, and is represented by the letter *m*. The inertia of the wheels being therefore $= 23$ ounces, will be denoted by 11 *m*. A and B are two boxes constructed so as to contain different quantities of matter, according as the experiment may require them to be varied: the weight of each box, including the hook to which it is suspended, $= 1\frac{1}{2}$ oz. or according to the preceding estimation, the weight of each box will be denoted by 6 *m*; these boxes contain such weights as are represented by fig. 122. each of which weighs an ounce, so as to be equivalent to 4 *m*; other weights of $\frac{1}{2}$ oz. $= 2m$, $\frac{1}{4}$ $= m$, and aliquot parts of *m*, such as $\frac{1}{8}m$, $\frac{1}{16}m$, may be also included in the boxes, according to the conditions of the different experiments hereafter described.

If $4\frac{1}{2}$ oz. or 19 *m*, be included in either box, this with the weight of the box itself will be 25 *m*; so that when the weights A and B, each being 25 *m*, are balanced in the manner above represented, their whole mass will be 50 *m*, which being added to the inertia of the wheels 11 *m*, the sum will be 61 *m*. Moreover, three circular weights, such as that which is represented at fig. 123. are constructed; each of which $= \frac{1}{2}$ oz. or *m*; if one of these be added to A and one to B, the whole mass will now become 63 *m*, perfectly in equilibrio, and moveable by the least weight added to either (setting aside the effects of friction), in the same manner precisely as if the same weight or force were applied to communicate motion to the mass 63 *m*, existing in free space and without gravity.

2. The moving Force. Since the natural weight or gravity of any given substance is constant, and the exact quantity of it easily estimated, it will be convenient here to apply a weight to the mass A as a moving force: thus, when the system consists of a mass $= 63m$, according to the preceding description, the whole being perfectly balanced, let a weight $\frac{1}{2}$ oz. or *m*, such as is represented in fig. 124. be applied on the mass A; this will communicate motion to the whole system: by adding a quantity of matter *m* to the former mass 63 *m*, the whole quantity of matter moved will now become

Motion of
Bodies.

become $64m$; and the moving force being $=m$, this will give the force which accelerates the descent of $A = \frac{m}{64m}$, or $\frac{1}{64}$ part of the accelerating force by which the bodies descend freely towards the earth's surface.

By the preceding construction, the moving force may be altered without altering the mafs moved; for fuppofe the three weights m , two of which are placed on A , and one on B to be removed, then will A balance B . If the weights $3m$ be all placed on A , the moving force will now become $3m$, and the mafs moved $64m$ as before, and the force which accelerates the descent of $A = \frac{3m}{64m} = \frac{3}{64}$ parts of the force by which gravity accelerates bodies in their free descent to the furface.

Suppofe it were required to make the moving force $2m$, the mafs moved continuing the fame. In order to effect this, let the three weights, each of which $=m$, be removed; A and B will balance each other; and the whole mafs will be $61m$: let $\frac{1}{2}m$, fig. 124, be added to A , and $\frac{1}{2}m$ to B , the equilibrium will ftill be preferved, and the mafs moved will be $62m$; now let $2m$ be added to A , the moving force will be $2m$, and the mafs moved $64m$, as before; wherefore the force of acceleration $= \frac{1}{32}$ part of the acceleration of gravity. Thefe alterations in the moving force may be made with great eafe and convenience in the more obvious and elementary experiments, there being no neceffity for altering the contents of the boxes A and B : but the proportion and abfolute quantities of the moving force and mafs moved may be of any affigned magnitude, according to the conditions of the propofition to be illuftrated.

3. *Of the fpace defcribed.* The body A , fig. 120, descends in a vertical line; and a fcale about 64 inches in length graduated into inches and tenths of an inch is adjufted vertical, and fo placed that the defcending weight A may fall in the middle of a fquare ftage, fixed to receive it at the end of the defcent: the beginning of the defcent is eftimated from o on the fcale, when the bottom of the box A is on a level with o . The defcent of A is terminated when the bottom of the box ftrikes the ftage, which may be fixed at different diftances from the point o ; fo that by altering the pofition of the ftage, the fpace defcribed from quiefcence may be of any given magnitude lefs than 64 inches.

4. *The time of motion* is obferved by the beats of a pendulum, which vibrates feconds; and the experiments, intended to illuftrate the elementary propofitions, may be eafily fo contructed that the time of motion fhall be a whole number of feconds: the eftimation of the time, therefore, admits of confiderable exactnefs, provided the obferver takes care to let the bottom of the box A begin its defcent precifely at any beat of the pendulum; then the coincidence of the ftroke of the box againft the ftage, and the beat of the pendulum at the end of the time of motion, will fhew how nearly the experiment and the theory agree together. There might be various mechanical devices thought of for letting the weight A begin its defcent at the inftant of a beat of the pendulum W ; let the bottom of the box A , when at o on the fcale, reft on a flat rod, held in the hand horizontally, its

No 200.

Motion of
Bodies.

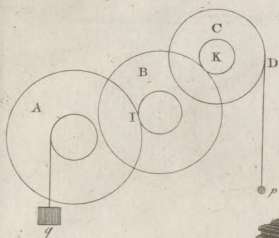
extremity being coincident with o , by attending to the beats of the pendulum; and with a little practice, the rod which fupports the box A may be removed at the moment the pendulum beats, fo that the defcent of A fhall commence at the fame inftant.

4. *Of the velocity acquired.* It remains only to defcribe in what manner the velocity acquired by the defcending weight A , at any given point of the fpace through which it has defcended, is made evident to the fenfes. The velocity of A 's defcent being continually accelerated will be the fame in no two points of the fpace defcribed. This is occafioned by the constant action of the moving force; and fince the velocity of A at any inftant is meafured by the fpace which would be defcribed by it, moving uniformly for a given time with the velocity it had acquired at that inftant, this meafure cannot be experimentally obtained, except by removing the force by which the defcending body's acceleration was caufed.

In order to fhew in what manner this is affected particularly, let us again fuppofe the boxes A and $B = 25m$ each, fo as together to be $= 50m$; this with the wheel's inertia $11m$ will make $61m$; now let m , fig. 122, be added to A , and an equal weight m to B , thefe bodies will balance each other, and the whole mafs will be $63m$. If a weight m be added to A , motion will be communicated, the moving force being m , and the mafs moved $64m$. In eftimating the moving force, the circular weight $= m$ was made ufe of as a moving force: but for the prefent purpofe of fhewing the velocity acquired, it will be convenient to ufe a flat rod, the weight of which is alfo $= m$. Let the bottom of the box A be placed on a level with o on the fcale, the whole mafs being as defcribed above $= 63m$, perfectly balanced in equilibrio. Now let the rod, the weight of which $= m$, be placed on the upper furface of A ; this body will defcend along the fcale precifely in the fame manner as when the moving force was applied in the form of a circular weight. Suppofe the mafs A , fig. 125, to have defcended by constant acceleration of force of m , for any given time, or through a given fpace: let a circular frame be fo affixed to the fcale, contiguous to which the weight defcends, that A may pafs centrally through it, and that this circular frame may intercept the rod m by which the body A has been accelerated from quiefcence. After the moving force m has been intercepted at the end of the given fpace or time, there will be no force operating on any part of the fyftem which can accelerate or retard its motion: this being the cafe, the weight A , the inftant after m has been removed, muft proceed uniformly with the velocity which it had acquired that inftant: in the fubfequent part of its defcent, the velocity being uniform will be meafured by fpace defcribed in any convenient number of feconds.

Other ufes of the inftrument. It is needlefs to defcribe particularly, but it may not be improper juft to mention the further ufes of this inftrument; fuch as the experimental eftimation of the velocities communicated by the impact of bodies elastic and nonelastic; the quantity of refiftance oppofed by fluids, as well as for various other purpofes. Thefe ufes we fhall not infift on; but the properties of retarded motion being a part of the prefent fubject, it may be neceffary to fhew

Fig. 118.



MECHANICS.

Fig. 125.

Plate CCXCI.

Fig. 120.

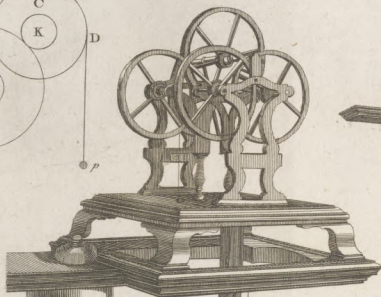


Fig. 119.

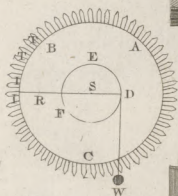


Fig. 122.



Fig. 117.

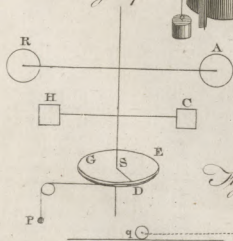


Fig. 116.



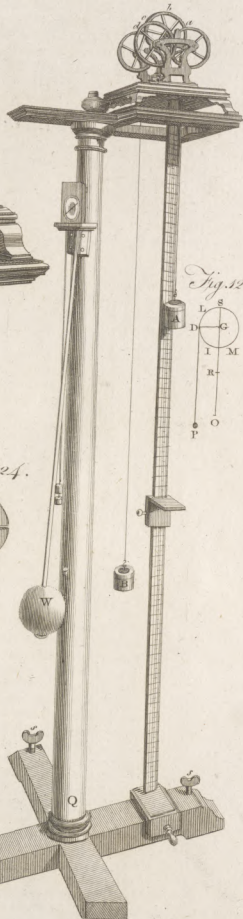
Fig. 124.



Fig. 123.



Fig. 121.



Motion of Bodies.

in what manner the motion of bodies resisted by constant forces are reduced to experiment by means of the instrument above described, with as great ease and precision as the properties of bodies uniformly accelerated. A single instance will be sufficient: Thus, suppose the mass contained in the weights A and B, fig. 125. and the wheels to be 61 *m*, when perfectly in equilibrio; let a circular weight *m* be applied to B, and let two long weights or rods, each = *m*, be applied to A, then will A descend by the action of the moving force *m*, the mass moved being 64 *m*: suppose that when it has descended any given space by constant acceleration, the two rods *m* are intercepted by the circular frame above described, while A is descending through it, the velocity acquired by that descent is known; and when the two rods are intercepted, the weight A will begin to move on with the velocity acquired, being now retarded by the constant force *m*; and since the mass moved is 62 *m*, it follows, that the force of retardation will be $\frac{1}{2}$ part of that force whereby gravity retards bodies thrown perpendicularly upwards. The weight A will therefore proceed along the graduated scale in its descent with an uniformly retarded motion, and the spaces described, times of motion, and velocities destroyed by the resisting force, will be subject to the same measures as in the examples of accelerated motion above described.

In the foregoing descriptions, two suppositions have been assumed, neither of which are mathematically true: but it may be easily shown that that are so in a physical sense; the errors occasioned by them in practice being insensible.

1. The force which communicates motion to the system has been assumed constant; which will be true only on a supposition that the line, at the extremities of which the weights A and B, fig. 120. are affixed, is without weight. In order to make it evident, that the line's weight and inertia are of no sensible effect,

let a case be referred to, wherein the body A descends through 48 inches from rest by the action of the moving force *m*, when the mass moved is 64 *m*; the time wherein A describes 48 inches is increased by the effects of the line's weight by no more than $\frac{1}{883}$ parts of a second; the time of descent being 3.9896 seconds, when the string's weight is not considered, and the time when the string's weight is taken into account = 4.0208 seconds; the difference between which is wholly insensible by observation.

2. The bodies have also been supposed to move in vacuo, whereas the air's resistance will have some effect in retarding their motion: but as the greatest velocity communicated in these experiments, cannot much exceed that of about 26 inches in a second (suppose the limit 26.2845), and the cylindrical boxes being about $\frac{1}{4}$ inches in diameter, the air's resistance can never increase the time of descent in so great a proportion as that of 240 : 241; its effects therefore will be insensible in experiment.

The effects of friction are almost wholly removed by the friction wheels; for when the surfaces are well polished and free from dust, &c. if the weights A and B be balanced in perfect equilibrio, and the whole mass consists of 63 *m*, according to the example already described, a weight of $\frac{1}{4}$ grains, or at most 2 grains, being added either to A or B, will communicate motion to the whole; which shows that the effects of friction will not be so great as a weight of $\frac{1}{4}$ or 2 grains. In some cases, however, especially in experiments relating to retarded motion, the effects of friction become sensible; but may be very readily and exactly removed by adding a small weight 1.5 or 2 grains to the descending body, taking that the weight added is such as is in the least degree smaller than that which is just sufficient to set the whole in motion, when A and B are equal and balance each other before the moving force is applied.

Motion of Bodies.

M E C

MECHOACAN, a province of Mexico, or New Spain, in America, bounded on the north by Panuco and Gaudalajara, on the east by Panuco and Mexico Proper, on the south by the Pacific Ocean, and on the west by Guadalaraja and the South Sea. The soil is exceedingly fertile; and the climate so wholesome, that the Spaniards imagine it to be possessed of some peculiarly restorative quality; for which reason the sick and infirm flock to it from all quarters. The commodities are sulphur, indigo, farfaparilla, safafaras, cacao, vanelloes, ambergrise, hides, wool, cotton, silk, sugar, the root mechoacan or white jalap, and silver. This province formed an independent kingdom at the time Mexico was reduced by Cortez. The sovereign had long been the inveterate enemy of the Mexicans, and was considered, next to the republic of Tlascala, as the most formidable barrier against the extension of the imperial frontier. However, he submitted to Cortez without striking a blow, being intimidated by the wonders he had performed with a handful of men; and thus Mechoacan became a province of the Spanish empire, and a valuable addition to Mexico.

Vol. X. Part II.

M E C

The country at that time was exceedingly populous, but the natives are now much thinned; and that rather by the luxury and effeminacy introduced by the Spaniards, than by their tyranny. The capital of the province is also called *Mechoacan* by the natives, but *Valladolid* by the Spaniards.

MECHOACAN, or *White Jalap*, in the materia medica, the root of an American species of convolvulus brought from Mechoacan, a province of Mexico, in thin slices like jalap, but larger, and of a whitish colour. It was first introduced into Europe about the year 1524, as a purgative universally safe, and capable of evacuating all morbid humours from the most remote parts of the body: but as soon as jalap became known, mechoacan gradually lost its reputation, which it has never since been able to retrieve. It is nevertheless by some still deemed an useful cathartic; it has very little smell or taste, and is not apt to offend the stomach; its operation is slow, but effectual and safe. Geoffroy affirms, that there is scarce any purgative accompanied with fewer inconveniences. It seems to differ from jalap only in being weaker; the

refins obtained from both have nearly the same qualities, but jalap yields five or six times as much as mechoacan; hence it is found necessary to exhibit the latter in six times the dose of the former to produce the same effects.

MECKLENBURG, a duchy of Germany, containing those of Schwerin and Güstrow, is bounded by Pomerania on the east, by part of the marquisate of Brandenburg and the duchy of Lüneburg on the south, the Baltic on the north, and Holstein and Saxe-Lauenburg on the west. Their greatest length is about 120 miles, and greatest breadth upwards of 60. With respect to the soil, much cannot be said in favour of it, as it consists in general, either of sand, or large and desolate heaths, interspersed with moors, woods, fens, and lakes. It yields very little wheat, and not a great deal of oats, rye, and barley; but breeds a considerable number of sheep and cattle, has plenty of fish, with stone-quarries, salt-springs, alum, iron, and some copper. The principal rivers here are the Elbe and Stör, which fall into the Elbe as it glides along the borders of this country to the south-west; the Reckenitz, which discharges itself into the Baltic; as do the Peene, the Warnow, and the Stopenitz. This country has only one harbour on the Baltic, namely that of Rostock. In both duchies, exclusive of Rostock, are 45 great and small cities, with three convents, and a great number of manors and farms, belonging either to the duke, the nobility, or convents. The peasants are in a state of villinage; but the nobility enjoy very considerable privileges. The states are composed of the nobility and towns; and the diets, which are summoned annually, are held alternately at Sternberg and Malchin. The duchy of Schwerin appoints four provincial counsellors, and that of Güstrow as many; who rank according to seniority with the duke's actual privy-counsellors, as their marshals do with the colonels. The lesser committee represents the whole body of the nobility and commons, by whom the members are chosen freely and without controul, and no edict relative to the whole country can be published without their consent, or in prejudice of their rights. The inhabitants of this country are mostly Lutherans, under their superintendants. There are also some Calvinists and Roman Catholics. Besides the grammar-schools in the towns, there is an university at Rostock. The commodities of the duchy are corn, flax, hemp, hops, wax, honey, cattle, butter, cheese, wool, and wood, a part of which is exported, but hardly any manufactures.

Of the house of Mecklenburg, there are two lines

still subsisting, viz. that of Schwerin and that of Strelitz. The latter commenced in duke Adolphus Frederick 11. younger brother of the duke of Schwerin, and grandfather of the present duke of Strelitz, Adolphus Frederick IV. who entered on the government in 1752, and whose family hath lately received a great additional lustre by his Britannic majesty's taking his second sister for his consort, and by her own great merit and noble deportment in that high station. Besides the duchy of Strelitz, to this duke belong the principality of Ratzeburg, with the lordship of Stargard, the ancient commanderies of Miro and Nemero, and a yearly pension of 9000 dollars out of the Boitzenburger toll. The title assumed by both the dukes is *duke of Mecklenburg, prince of Wenden, Schwerin, and Ratzeburg, count of Schwerin and the country of Rostock, and lord of Stargard*. By the agreement concluded at Wittstock in 1442, the elector of Brandenburg, on the extinction of the male-line of the dukes of Mecklenburg, is entitled to their whole succession. The duke of Schwerin has two votes both in the diet of the empire and that of the circle. The matricular assessment for the duchies of Schwerin and Güstrow is 40 horse and 67 foot, or 748 florins monthly, including what is paid by Sweden for Wismar, and the bailiwicks of Poll and Neukloster. To the chamber of Wetzlar, these two duchies pay each 243 rix-dollars, 43 kruitzen. For the government of Mecklenburg, the administration of justice, and the management of the revenue, there is the privy council of regency, the demesne-chamber, the high and provincial court of justice, to which appeals lie in most causes, both from the consistory and the inferior civil courts, and which are common to both the dukes. As to the revenues, those of the Schwerin line must be very considerable, those arising from the demesne-bailiwicks and regalia alone amounting to 300,000 rix-dollars per annum. There is a tax on land that produces no contemptible sum, and that called the *prince's tax* is fixed at 20,000 rix-dollars: besides all these, there are also free-gifts. The whole revenues of the Strelitz branch are estimated at 120,000 rix-dollars. Each of these princes maintains a body of troops.

MECONIUM, the excrement contained in the guts of an infant at its birth. If this matter is not soon purged off, it occasions gripes, &c. A tea-spoonful of true castor oil is an excellent purge in this case; but the first milk from the mother's breast is usually sufficient, if it flows in due time.

MECONIUM, in pharmacy, the extract of British poppies. It has all the virtues of foreign opium, but in a somewhat lower degree.

DIRECTIONS FOR PLACING THE PLATES OF VOL. X.

Plate	PART I.	Page	Plate	Page
CCLXX. to face	- - -	8	CCLXXX.	598
CCLXXI.	- - -	12	CCLXXXI.	639
CCLXXII.	- - -	113	CCLXXXII.	728
CCLXXIII.	- - -	117	CCLXXXIII.	734
CCLXXIV.	- - -	313	CCLXXXIV.	741
CCLXXV.	- - -	352	CCLXXXV.	744
			CCLXXXVI.	748
	PART II.		CCLXXXVII.	753
CCLXXVI.	- - -	433	CCLXXXVIII.	757
CCLXXVII.	- - -	445	CCLXXXIX.	761
CCLXXVIII.	- - -	448	CCXC.	776
CCLXXXIX.	- - -	546	CCXCI.	784

In all, 22 Plates.

E R R A T A.

Page 121. col. 1. line 30. For "*Lord Napier, Baron of Merchilton*," read "*John Napier, Baron*," &c. And for "*Lord Napier*," in different other places in the course of the article, read "*Baron Napier*." The same error has been fallen into by several former writers, when treating of the invention of Logarithms. *John*, above mentioned, the real author of that invention, was, according to the custom of Scotland in his time, called *The Baron of Merchilton*; *Baron* being an appellation then given to all the great landholders, but which did not confer or imply the title of *Lord*. The first *Lord Napier* was *Archibald*, eldest son of the illustrious inventor of the Logarithms.

- P. 309. col. 1. l. 8. For *paternat*, read *paternat*.
 413. col. 2. line 26. For *Goetic*, read *Goetic*.
 537. col. 2. l. 16. from bottom. For *CASIA*, read *CASSIA*.
 651. in the Title of the Catalogue of Simples. For *method*, read *methods*.
 652. col. 1. l. penult. Delete the parenthesis after *med*.
 653. col. 1. l. 9. For *Sifon*, read *Sifon amomum*.
 — col. 1. l. 13. For *con*, read *com*. or *communis*.
 — col. 1. l. 17. For *arvensis*, read *A. arvensis*.
 — foot-note, l. 4. For *antidyfenteria*, read *antidyfenterica*.
 655. col. 1. l. 3. For *fistulous*, read *fistulosus*.
 — col. 1. l. 20. For *balsaminum*, read *balsamita*.
 — col. 1. l. 35. For *balsaminum*, read *balsamum*.
 — col. 3. l. 11, 12, 13, 14, 15. For *rofin*, read *resin*.
 656. col. 1. l. 31. For *Chenopidium*, read *Chenopodium*.
 658. foot-note, l. penult. For *at*, read *as*.
 661. col. 5. l. 21. For *nameo a*, read *name to a*.
 665. col. 1. l. 16. 17. For *Fi. cureligiosa*, read *Ficu religiosa*.
 — col. 1. l. 49. For *Fædus*, read *H. fetidus*.
 666. col. 1. l. penult. For *Plychatria*, read *Plychotria*.
 677. col. 1. l. 9. 10. from bot. For *Datura stramon*, read *Datura stramonium*. or *stramonium*.
 678. col. 1. l. 14. from bot. For *Verpascum*, read *Verbascum*.
 — col. 5. l. 15. For *England*, read *Erland*.

N.B. On account of the manner in which it was necessary to begin the ensuing Volume, the present one wants about 12 pages of the usual quantity, for which an equivalent shall be duly added in the next.



